

Polling and Political Behaviour: Explaining inaccuracy in Italian polling

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Contents

| | | |
|----------|--|-----------|
| 1 | Motivation | 8 |
| 1.1 | Introduction | 8 |
| 1.2 | Reasons | 11 |
| 1.3 | Overview | 13 |
| 2 | Literature Review | 15 |
| 2.1 | Introduction | 15 |
| 2.2 | The Italian experience of polling and the electoral system | 16 |
| 2.3 | Polls and election campaign | 24 |
| 2.4 | Polls: definition | 30 |
| 2.5 | Polls: problem | 34 |
| 2.6 | Research question and hypotheses | 42 |
| 3 | Methodology | 46 |
| 3.1 | Introduction | 46 |
| 3.2 | Accuracy Measure | 48 |
| 3.3 | House Effect Measure | 54 |
| 3.3.1 | Model and Revision | 60 |
| 3.4 | Voter Sentiment Measure | 63 |
| 3.5 | Conclusion | 73 |
| 4 | 2006 Italian General Election | 75 |
| 4.1 | Introduction | 75 |
| 4.2 | Accuracy Results | 77 |
| 4.2.1 | Findings | 79 |
| 4.3 | House Effect Results | 85 |
| 4.3.1 | Findings | 86 |

| | | |
|----------|---|------------|
| 4.4 | Voter Sentiment Results | 99 |
| 4.4.1 | Analysis of Variance | 100 |
| 4.4.2 | AR(1) Results | 104 |
| 4.5 | Conclusion | 109 |
| 5 | 2008 Italian General Election | 111 |
| 5.1 | Introduction | 111 |
| 5.2 | Accuracy Results | 113 |
| 5.2.1 | Findings | 115 |
| 5.3 | House Effect Results | 131 |
| 5.3.1 | Findings | 132 |
| 5.4 | Voter Sentiment Results | 158 |
| 5.4.1 | Analysis of Variance | 158 |
| 5.4.2 | AR(1) Results | 166 |
| 5.5 | Conclusion | 175 |
| 6 | 2013 Italian General Election | 178 |
| 6.1 | Introduction | 178 |
| 6.2 | Accuracy Results | 180 |
| 6.2.1 | Findings | 182 |
| 6.3 | House Effect Results | 195 |
| 6.3.1 | Findings | 196 |
| 6.4 | Voter Sentiment Results | 220 |
| 6.4.1 | Analysis of Variance | 221 |
| 6.4.2 | AR(1) Results | 229 |
| 6.5 | Conclusion | 234 |
| 7 | Conclusion | 237 |
| 7.1 | The predictive accuracy | 239 |
| 7.2 | The degree of house effect | 240 |
| 7.3 | The extent of voters sentiment change | 241 |
| 7.4 | The overall type of polls performance | 241 |
| 8 | References | 243 |
| A | Appendix | 252 |

List of Figures

| | | |
|-----|---|-----|
| 2.1 | Different types of poll performance on the basis of their accuracy/inaccuracy | 43 |
| 4.1 | 2006 Italian General Election polls for the three coalitions over the six months of the election campaign. | 80 |
| 4.2 | Accuracy values applying A and A' measures and their confidence intervals | 84 |
| 4.3 | Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Casa Delle Libertà. | 91 |
| 4.4 | Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Unione. | 93 |
| 4.5 | Linear and smoothed plots of house-adjusted polls aggregated by date: Others. | 94 |
| 5.1 | 2008 Italian General Election polls for the five parties/coalitions over the six months of election campaign | 116 |
| 5.2 | Accuracy values applying A and A' measures and their confidence intervals: Popolo delle Libertà and Partito Democratico | 125 |
| 5.3 | Accuracy values applying A' measures and their confidence intervals: UDC, SA, and Others | 126 |
| 5.4 | Accuracy values applying A' measures and their confidence intervals: Centre Right and Centre Left Coalition | 129 |
| 5.5 | Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Popolo delle Libertà | 140 |
| 5.6 | Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Partito Democratico | 142 |

| | | |
|------|---|-----|
| 5.7 | Linear and smoothed scatter plots of house-adjusted polls aggregated by date: UDC | 143 |
| 5.8 | Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Sinistra Arcobaleno | 145 |
| 5.9 | Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Others | 146 |
| 5.10 | Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Centre Right Coalition | 147 |
| 5.11 | Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Centre Left Coalition | 148 |
| 6.1 | 2013 Italian General Election polls for the six parties/coalitions over six months of election campaign | 183 |
| 6.2 | Accuracy values applying A and A' measures and their confi- dence intervals: Popolo Delle Libertà, Partito Democratico and Movimento 5 Stelle | 190 |
| 6.3 | Accuracy values applying A' measures and their confidence intervals: Centre, Fare per Fermare il Declino, Rivoluzione Civile and Others | 192 |
| 6.4 | Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Popolo Delle Libertà | 203 |
| 6.5 | Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Partito Democratico | 205 |
| 6.6 | Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Movimento 5 Stelle | 206 |
| 6.7 | Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Centre | 208 |
| 6.8 | Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Fare per Fermare il Declino | 209 |
| 6.9 | Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Rivoluzione Civile | 210 |
| 6.10 | Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Others | 211 |

| | | |
|------|---|-----|
| A.1 | Smoothed scatter plots of house-adjusted polls aggregated by date: Casa Delle Libertà. | 257 |
| A.2 | Smoothed scatter plots of house-adjusted polls aggregated by date: Unione. | 258 |
| A.3 | Smoothed scatter plots of house-adjusted polls aggregated by date: Others. | 258 |
| A.4 | Smoothed scatter plots of house-adjusted polls aggregated by date: Popolo delle Libertà | 259 |
| A.5 | Smoothed scatter plots of house-adjusted polls aggregated by date: Partito Democratico | 260 |
| A.6 | Smoothed scatter plots of house-adjusted polls aggregated by date: UDC | 260 |
| A.7 | Smoothed scatter plots of house-adjusted polls aggregated by date: Sinistra Arcobaleno | 261 |
| A.8 | Smoothed scatter plots of house-adjusted polls aggregated by date: Others | 261 |
| A.9 | Smoothed scatter plots of house-adjusted polls aggregated by date: Centre Right Coalition | 262 |
| A.10 | Smoothed scatter plots of house-adjusted polls aggregated by date: Centre Left Coalition | 262 |
| A.11 | Smoothed scatter plots of house-adjusted polls aggregated by date: Popolo Delle Libertà | 263 |
| A.12 | Smoothed scatter plots of house-adjusted polls aggregated by date: Partito Democratico | 263 |
| A.13 | Smoothed scatter plots of house-adjusted polls aggregated by date: Movimento 5 Stelle | 264 |
| A.14 | Smoothed scatter plots of house-adjusted polls aggregated by date: Centre | 264 |
| A.15 | Smoothed scatter plots of house-adjusted polls aggregated by date: Fare per Fermare il Declino | 265 |
| A.16 | Smoothed scatter plots of house-adjusted polls aggregated by date: Rivoluzione Civile | 265 |
| A.17 | Smoothed scatter plots of house-adjusted polls aggregated by date: Others | 266 |

List of Tables

| | | |
|-----|---|-----|
| 2.1 | Number of polls published in Italy between 2000 and 2013 . . . | 19 |
| 4.1 | 2006 Italian General Election polls on Chamber of Deputies: comparison of percentage of inaccuracy applying A , A' , and B_w measures. | 81 |
| 4.2 | 2006 Italian General Election polls on Chamber of Deputies: monthly average and percentage of inaccuracy of A , A' , and B_w measures. | 82 |
| 4.3 | 2006 Italian General Election: House Effect analysis using OLS regression with no intercept and poll readings and poll's accuracy values as dependent variables | 88 |
| 4.4 | House effect across the 2006 Italian General Election polls on Chamber of Deputies: Multivariate Regression Model using A , A' and B_w measures as dependent variables. | 96 |
| 4.5 | 2006 Italian General Election polls on Chamber of Deputies: analysis of variance all sample (October - March). | 101 |
| 4.6 | 2006 Italian General Election polls on Chamber of Deputies: analysis of variance two months (February and March). | 102 |
| 4.7 | 2006 Italian General Election: true voters sentiment change using AR(1) for the Casa Delle Libert . | 105 |
| 4.8 | 2006 Italian General Election: true voters sentiment change using AR(1) for the Unione. | 107 |
| 4.9 | 2006 Italian General Election: true voters sentiment change using AR(1) for the Others. | 108 |

| | | |
|------|--|-----|
| 5.1 | 2008 Italian General Election polls on Chamber of Deputies: comparison of percentage of inaccuracy applying A , A' , and B_w measures | 118 |
| 5.2 | 2008 Italian General Election polls on Chamber of Deputies: monthly average and percentage of inaccuracy of A , A' , and B_w using all parties/coalitions | 121 |
| 5.3 | 2008 Italian General Election polls on Chamber of Deputies: monthly average and percentage of inaccuracy of A' and B_w using three coalitions. | 128 |
| 5.4 | 2008 Italian General Election polls on Chamber of Deputies: House Effect analysis using OLS regression with no intercept and poll readings as dependent variable | 134 |
| 5.5 | 2008 Italian General Election polls on Chamber of Deputies: House Effect analysis using OLS regression with no intercept and polls' accuracy as dependent variable | 137 |
| 5.6 | House effect across the 2008 Italian General Election polls on Chamber of Deputies: Multivariate Regression model using A and B_w measures as dependent variables | 151 |
| 5.7 | House effect across the 2008 Italian General Election polls on Chamber of Deputies: Multivariate Regression model us- ing A' measures for all the parties/coalitions as dependent variables. | 153 |
| 5.8 | House effect across the 2008 Italian General Election polls on Chamber of Deputies: Multivariate Regression model using A' measures for only three parties/coalitions as dependent variables. | 156 |
| 5.9 | 2008 Italian General Election polls on Chamber of Deputies: analysis of variance all sample (October - March) | 160 |
| 5.10 | 2008 Italian General Election polls on Chamber of Deputies: analysis of variance in the last two months (February and March). | 162 |
| 5.11 | 2008 Italian General Election: true voters sentiment change using AR(1) for Popolo della Libertà. | 167 |

| | | |
|------|--|-----|
| 5.12 | 2008 Italian General Election: true voters sentiment change using AR(1) for Partito Democratico. | 169 |
| 5.13 | 2008 Italian General Election: true voters sentiment change using AR(1) for UDC. | 170 |
| 5.14 | 2008 Italian General Election: true voters sentiment change using AR(1) for Sinistra Arcobaleno. | 171 |
| 5.15 | 2008 Italian General Election: true voters sentiment change using AR(1) for Others. | 172 |
| 5.16 | 2008 Italian General Election: true voters sentiment change using AR(1) for Centre Right. | 173 |
| 5.17 | 2008 Italian General Election: true voters sentiment change using AR(1) for Centre Left. | 174 |
| 6.1 | 2013 Italian General Election polls on Chamber of Deputies: comparison of percentage of inaccuracy applying A , A' , B and B_w | 184 |
| 6.2 | 2013 Italian General Election polls on Chamber of Deputies: monthly average and percentage of inaccuracy of A , A' , and B_w using all the coalitions. | 186 |
| 6.3 | 2013 Italian General Election polls on Chamber of Deputies: monthly average and percentage of inaccuracy of A' , and B_w using three parties/coalitions | 193 |
| 6.4 | 2013 Italian General Election polls on Chamber of Deputies: House Effect analysis using OLS regression with no intercept and poll readings as dependent variable. | 198 |
| 6.5 | 2013 Italian General Election polls on Chamber of Deputies: House Effect analysis using OLS regression with no intercept and accuracy values as dependent variable. | 201 |
| 6.6 | House effect across the 2013 Italian General Election polls on Chamber of Deputies: Multivariate Regression model using A and B_w measures as dependent variables. | 213 |
| 6.7 | House effect across the 2013 Italian General Election polls on Chamber of Deputies: Multivariate Regression model using A' measures as dependent variables. | 215 |

| | | |
|------|---|-----|
| 6.8 | House effect across the 2013 Italian General Election polls on Chamber of Deputies: Multivariate Regression model using A' measures for only three parties/coalitions as dependent variables. | 219 |
| 6.9 | 2013 Italian General Election polls on Chamber of Deputies: analysis of variance all sample (August - February) | 223 |
| 6.10 | 2013 Italian General Election polls on Chamber of Deputies: analysis of variance two months (10th Dec - 9th Feb) | 225 |
| 6.11 | 2013 Italian General Election: true voters sentiment change using AR(1) for Popolo della Libertà. | 230 |
| 6.12 | 2013 Italian General Election: true voters sentiment change using AR(1) for Partito Democratico. | 231 |
| 6.13 | 2013 Italian General Election: true voters sentiment change using AR(1) for Movimento 5 Stelle. | 232 |
| 6.14 | 2013 Italian General Election: true voters sentiment change using AR(1) for Centre. | 233 |

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Statement of Originality

The work contained in this thesis has not been previously submitted for a degree or diploma at any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due references are made.

Abbreviations

AR(1) = Autoregressive Model of order 1

AGCOM = Autorità per le garanzie nelle comunicazioni

CAP = Computer Assisted Personal Interview

CATI = Computer Assisted Telephone Interview

CAWI = Computer Assisted Web Interview

CDL = Casa delle Libertà

CR = Centre - Right Coalition

CL = Centre - Left Coalition

DC = Democrazia Cristiana Party;

DCEP = Difference between the two major parties/coalitions in the electoral race as estimated by polls

FFD = Fare per Fermare il Declino

M5S = Movimento 5 Stelle

PAP = Paper and Pencil Interview

PCI = Partito Comunista Italiano

PD = Partito Democratico

PDL = Partito delle Libertà

O = Others

SA = Sinistra Arcobaleno

RC = Rivoluzione Civile

U = Unione

UDC = Unione Democratici Cattolici e di Centro Party

Abstract

The use of polls during election campaigns has become increasingly commonplace, its main purpose being to predict elections results. Some literature highlights evidence that pre-electoral polls increase their predictive accuracy as the time between the interview and Election Day decreases. Understanding why some polls get it right and others get it wrong is important to better ascertain the evolution of election campaigns and voting intentions across time. A considerable literature shows how the quality of poll predictions is affected by a variety of methodological decisions taken by pollsters. This raises the question that underlies this thesis: under what conditions are polls inaccurate as predictors of voters' behaviour? In order to answer this question, we analyze the last three Italian general elections. The aim of this thesis is to estimate what has the greatest impact on inaccuracy in Italian polling between the house effect and voters sentiment change. To do that, we firstly revise the well-established accuracy measures used so far in order to fit the Italian case and the new accuracy measure proposed for multi-party systems (B_w). Then, we estimate the house effect using OLS and multivariate regression models, where the days and polling houses and the methodologies employed by pollsters are

the explanatory variables respectively. To estimate the extent of voters sentiment change in Italian voters, we apply the autoregressive model. The evidence provided by the accuracy measures shows a high presence of inaccuracy in Italian polling. Moreover, the OLS models provide strong evidence of the house effect, whereas the autoregressive model does not confirm the hypothesis of voters sentiment change across time. Therefore, the greater cause of inaccuracy in Italian polling is the house effect rather than any movement in voting intentions in the last three general elections.

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Chapter 1

Motivation

Gli uomini non possono essere compresi per
ciò che dicono o possono dire: anche se con la
miglior buona volontà e sincerità, ciò che la
gente racconta non corrisponde
necessariamente a quello che realmente fa o
farà

W. Pareto

1.1 Introduction

Over the last two decades, the use of pre-electoral polls during election campaigns has become increasingly commonplace. They are mostly used to show the likely electoral results. “As long as there have been elections, people have tried to predict the outcomes” (Hillygus 2011). Indeed, some of the literature provides evidence to conclude that poll predictions are related to electoral results and, especially, that the predictive accuracy of polls increases as the time between the interview and Election

Day decreases (Gelman and King 1993; Erikson and Wlezien 1999; Jennings and Wlezien 2015).

However, their failure to predict the winner has caused concern about their reliability and accuracy (Crespi 1988; Converse and Traugott 1986; Callegaro and Gasperoni 2008; Erikson and Wlezien 1999). Despite this, pre-electoral polls are used during an election campaign in developed democracies in order to estimate voters' future behaviour. This raises the question underlying this thesis: to what extent does polling accurately record real changes in electoral preference? To answer this question, we will analyze the last three Italian general elections and their outcomes, to see what evidence they provide concerning reliability and accuracy in the Italian case.

The Italian experience of pre-electoral polls (hereafter referred to as polls) is different from that of other European countries and the USA in at least two respects: politically and culturally. Regarding the former, the reason lies in the features of the Italian political system during the so-called First Republic. Indeed, it was characterized by the presence of two large parties, the Christian Democrats and the Italian Communist Party, that divided voters into two main groups. Therefore, Italian election campaigns did not have a horse-race style, like the other Western countries did, until the 1990s. The use of polls was considered pointless given the absence of real competition between parties to win the elections. Regarding the cultural aspect, the purpose in carrying out a poll was mainly academic before the *Clean Hands* scandal. Italian public opinion was not considered an active actor in

political life. As matter of fact, the first Italian polling institution (Doxa) conducted surveys on its own initiative until the 1990s, because none of the parties or other institutions had ever commissioned one.

Forecasting an election is challenging and the understanding of why some polls get it right and others get it wrong is important to better ascertain the evolution of election campaigns and, above all, voters' voting intentions across time. Indeed, there is a vast literature showing that the quality of polls is affected by sampling error, non-response sets, and so on (Groves *et al.* 2009). For instance, random samples may produce variation among polls because they include a sample of respondents rather than of populations. This error is shown in the margin error and it could be resolved by increasing the sample size. Another source of error is the design decision undertaken by the pollster. Some academic works have provided evidence of bias deriving, for instance, from the number and type of days in the field (Lau 1994). According to this, there are a variety of methodological decisions taken by pollsters that affect the quality of poll predictions, such as the definition of likely voters or how to treat the share of undecided voters.

The estimation of poll accuracy is not the only way to assess the performance of the pollsters, but it has certainly been the most common so far. Poll results vary over the course of election campaigns and across polling organizations, making it difficult to track genuine changes in voters' support (Jackman 2005; Erikson and Wlezien 1999; Pickup and Johnston 2008). Pollsters know that to maintain their credibility they must forecast accurately. For instance, retrospective analysis of poll

accuracy also provides us information to assess the *reputation* of polling houses. A good example is the death of the *Literary Digest* newspaper after its failure to predict the 1936 Presidential election despite the fact that from 1916 to 1932 it was able correctly to predict the election results.

This thesis tries to shed light on the relationship between voter behaviour and polling. In particular, the aim is to explore the conditions under which the latter is an inaccurate method of recording and predicting voters' voting intentions. To quote Roper's words, "if a study deals with a matter of facts [...] it is more likely to be accurate than if it is measuring an opinion [...] And surveys measuring opinion are likely to be more accurate than those measuring future intentions" (1984:28).

1.2 Reasons

The literature on the predictive accuracy of Italian polling over election campaigns has grown rapidly only in the last few years. When starting this thesis, there were few academic works on Italian elections and none of them took into account the accuracy of polls across elections. Instead, these studies focus on the performance of polls in predicting the electoral results, only considering one election at a time and just the two major parties/coalitions, according to the statistical measure applied (Callegaro and Gasperoni 2008; D'Agata and Tomaselli 2013). None of these works investigate the predictive accuracy of Italian polling across time taking into account the multi-party and multi-coalition features of the Italian political system by revis-

ing the accuracy measures. Moreover, the originality of the Italian case lies in the fact that it allows us to fill at least three gaps in the literature. Firstly, Italy has a multiparty system and so far, all the academic works have been mainly focused on the American system concerning the accuracy and the reliability of poll predictions. Specifically, we will employ several accuracy measures and revise them in order to fit with a multi party system like Italy and a new measure designed for this political system. In addition, the two hypotheses later drawn in this thesis estimate which factor most affects the accuracy of poll predictions in the Italian polling. In other words (to our knowledge), this thesis represents one of the few academic works in the literature that simultaneously investigates the accuracy and the causes of inaccuracy among poll predictions for a multi-party system across time. Secondly, the most important purpose of this thesis is to show which factor most affects the accuracy of poll predictions. In other words, this thesis aims not only to show how many polls are classified as inaccurate in Italian polling in the last three general elections, but to investigate what causes inaccuracy among them using different approaches and models. To do that, a statistical analysis of the two major factors that in the literature are considered to affect poll inaccuracy the most will be undertaken: the factors are the house effect and voters sentiment change. The purpose is to discover which of them is more responsible for the discrepancy between poll predictions and electoral results in Italian polling. Thirdly, the role of polls in election campaigns has experienced a fast-growing importance in Western European countries over the last few decades. Shedding light on the accuracy and the causes of inaccuracy of poll

predictions also allows us to examine the election campaign itself in more depth.

1.3 Overview

In the next chapter, we will review the literature on the Italian polling experience so far and all the issues linked with the use of polls as a forecast method. Specifically, the first part of the chapter is devoted to explaining the Italian experience of polling and we compare it to that of other countries. In addition, we will discuss the use of polls during election campaigns, focusing on their role so we can ascertain the fundamentals of election campaigns. The principal issues concerning the use of polls to estimate election results will be discussed by introducing the methodological problems linked with carrying them out during an election campaign (e.g. the question wording). Following the literature on polling and the Italian experience, we will describe the main research question and the hypotheses of this thesis. In chapter 3, we will present the statistical methodologies employed in order to test the two hypotheses on the main causes of inaccuracy in Italian polling. Specifically, this chapter will discuss how to revise the well-established accuracy measures used so far in order to fit the Italian case and the new accuracy measures proposed for the multi-party system. These measures provide evidence of the amount of polls classified as inaccurate and the overall degree of error in poll readings over the three elections respectively. Then, we will describe the two main approaches to estimating the house effect and we will introduce the autoregressive model and its application

to estimate voters sentiment change in Italian voters. In addition, all sections will describe how to revise these procedures in order to fit the Italian case. Chapters 4, 5, and 6 will be devoted to presenting the outcomes of analysis of accuracy, house effect, and voters sentiment change over the last three Italian general elections (2006, 2008, and 2013). Specifically, each chapter will show the extent of inaccuracy and the degree error given by house effect and/or voters sentiment change in Italian polling over the three campaigns.

Chapter 2

Literature Review

2.1 Introduction

This chapter is devoted to presenting a literature review of the main topics concerning the accuracy of polls during election campaigns, the Italian experience of polling, and the main factors that affect the predictive accuracy of polls. Specifically, many scholars have shown concern about the use of polls to predict the winner in an election competition (Crespi 1988; Coverse and Traugott 1986; Callegaro and Gasperoni 2008; Erikson and Wlezien 1999). Despite this, in recent decades the discussion of polls has mainly focused on the their capability of recording the level of support for political parties at the time they are carried out (Hillygus 2011).

This seems to be particularly the case in Italy, where for a long time polls have been the private business of pollsters and, in a few cases, something between pollsters and politicians. Only since the 2006 general election have Italian campaigns begun

to be characterized by the presence of polls but with the purpose of predicting the winner rather than of just recording the level of support for the political parties over the course of the election campaign.

With this in mind, the remainder of this chapter is structured as follows. In the next section, we will explain the Italian experience of polling particularly in light of the experiences of other countries. In section three, we will discuss the use of polls in the election campaigns focusing on their role in ascertaining their *fundamentals* of election campaigns. In the last section, we will present the principal issues concerning the use of polls to estimate the election results. Specifically, this section will discuss the methodological problems linked to carrying out polls over an election campaign (like the question wording). The last section will present the research question and hypotheses of this thesis.

2.2 The Italian experience of polling and the electoral system

The Italian experience of polling is different from that of other European countries and the US in at least two respects: politically and culturally. With regard to the former, the first appearance of polls in Italy dates back to the beginning of democracy immediately after the end of Fascism. In fact, the first poll was carried out in Sicily in 1943 by the US army, with the purpose of investigating whether it was a method applicable even in a non-democratic, non- Anglo Saxon country. How-

ever, this American influence caused scepticism in the two largest Italian parties. For instance, the Italian Communist Party (PCI) had a strongly critical attitude to polls because it saw them as an American product, and therefore as something inherently suspect given the influences of Marxist culture. Given such assumptions, polls were viewed as tools to reduce and even destroy the role of the politics of class-consciousness (Reda 2011; Rinauro 2002). The Italian political system of the First Republic was characterized by two factors, the first being the deep-rootedness of two large parties, known as “church-parties”, the Christian Democrats (DC) and the PCI, which divided voters into two groups, to one or the other of which the majority of them belonged. Secondly, there was no alternation in government. The parties further to the right and the left were considered to be ‘anti-system’ and therefore unavailable as potential governing partners. Under these circumstances the DC, in the centre of the spectrum, was the largest party and the mainstay of all feasible governing coalitions with no possibility of the opposition parties being able to come together to offer voters the prospect of a governing alternative. For this reason, Italian election campaigns had none of the horse race features characteristic of contests between parties in systems that are bipolar. Before the 1990s, then, polls were considered pointless due to the absence of majoritarian competition between parties for control of the executive. This is also the reason why the fast-growing presence of polls in Italian political life occurred only after the fall of the Berlin Wall, which brought an end to the sharp ideological cleavage between the two big parties in Italy, the DC and the PCI, and precipitated the *Clean Hands* (Mani

Pulite) scandal. This gave public opinion a role it had never played before in Italian political life, as well as bringing about the birth of Forza Italia, which was looking for legitimation and support using new forms of political communication (*in primis* opinion polls). With regard to the cultural factor (which is also a consequence of the political factors), the former Italian pollsters were essentially only statisticians rather than sociologists, political scientists or economists. Therefore, polls were used more for the purpose of scientific and academic inquiry than for political market analysis, as in most other European countries and the US. For instance, the first Italian polling institution, Doxa, conducted surveys on its own initiative until the 1990s, because none of the parties or other institutions had ever commissioned any from it. Before the so called ‘Second Republic’, the use of opinion polls was sporadic and only carried out on the initiative of polling institutions themselves and in a few cases by the DC. The latter recognized the capacity of polls to give it information not only about who would be likely to vote for the party, but also about the public’s attitudes with regard to political issues. For instance, the DC commissioned polls to ascertain what the public wanted in terms of policy orientations. The Italian pollster did not consider public opinion as an active actor in political life; rather, it was seen as the audience and the principal news to talk about (Reda 2011). In light of this, the early 1990s brought about a new relationship between politicians and public opinion mediated by polls. The major factors surrounding the growing use of polls in Italian political life are the decline of political parties and the greater personalization of politics.

The 1994 general election was the first Italian election campaign entirely managed and addressed on the basis of directions provided by the Prime Minister candidates. This idea was further consolidated over the next five years thanks to Silvio Berlusconi, who employed marketing strategies in election campaigns and also a massive use of polls to select the issues for the ‘public’ to refer to. Meanwhile, in 1993 the Italian parliament promulgated a law establishing an embargo on the publication of polls during the fifteen days leading up to the days of elections; the pollsters had to publish a form along with the polls containing all the methodological features employed to carry them out. In 2000, this law was strengthened through the following three points: the polls must not be published during the fifteen days prior to Election Day; the Italian authority for the communications and publishing (Agenzia per le comunicazioni - AGCOM) was the only one entitled to establish the standards that pollsters must follow when carrying out a poll; and all the polls must be published on the official website managed by AGCOM, including a form with the methodological features. In the following years, attention given to polls experienced a growth in Italian political life thanks to their publication in media such as TV debates or newspapers.

Table 2.1: Number of polls published in Italy between 2000 and 2013

| 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | Tot |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| 23 | 148 | 139 | 59 | 227 | 262 | 303 | 319 | 345 | 308 | 438 | N/A | 342 | 650 | 3.563 |

Source: Self elaboration of data obtained from www.sondaggiopoliticoelettorali.it

As table 2.1 shows, the number of polls published in the last 14 years shows a rising trend. Indeed, their publication *per year* rose from 23 to 650. In the last decade in Italy, polls have had a stable position in political life, allowing them to estimate opinions among voters, especially close to and during the election campaign. However, Reda (2011) has pointed out that this experience is different from that in other countries like the US and France, where there is a more extensive publication of polls. Indeed, one of the features of the Italian case is that there are still fewer polls published across the year than in any other Western democracy. This is also due to the role of television in Italian social and political life. In the light of this, Mazzoleni and Sfardini (2009) have pointed out that polls have established their position in Italian political life as strong communication tools used by the media and, in particular, by television. In other words, polls became an important part of *infotainment*. Moreover, it was not unusual in the press to find a link between this use of polls and Berlusconi's entrepreneurial political style, especially during election campaigns. For instance, Reda (2012) reported that there were 150 titles in the press dedicated to the linkage between polls and Berlusconi over 12 years (1998 - 2010). This never happened to either the left or to other Italian political parties of the right. Therefore, the use of polls in Italy has been constantly linked to Berlusconi, thanks also to his personal relationship with the director of Diakron (polling institution) Gianni Pilo, who was also a deputy of the Casa delle Libertà between 1994 and 1996.

Moreover, Berlusconi applied a management strategy concerning the use of polls.

A positive poll results in terms of level of support for a given political party might produce a double effect. On the one hand, it keeps the voters reassured about the strength of the party, and on the other hand, the higher level of support frightens rival parties. Berlusconi is the first politician in Italy clearly to use polls as a strong communication tool for victory or to regain losses of share with the purpose of taking advantage of the classical bandwagon and underdog effects. The first happens when the voter is more likely to vote for the candidate who is the front-runner in terms of the poll readings. In this case, the individuals' knowledge that one or the other candidate is favoured to win induces them to support that candidate, thanks to psychological mechanisms that are either cognitive or affective or some combination of both. In the former case the individual, required to make a choice, has recourse to the fallacious *argumentum ad populum* ('The majority of people support Berlusconi so he must be the best candidate') in order to decide. In the latter case, the individual seeks to avoid the discomfort of feeling alone or in a minority. Conversely, the underdog effect occurs when the voter is more likely to vote for the candidate who is the loser according to the same forecast.

According to Pagnocelli and Vannucci (2006), there is a good correlation between the declaration of voting intentions and expectations about who will be the winner in the election. If the overall of sample is confident of a centre-left victory, the percentage of voters declaring that they will vote for the centre-left increases. In addition, the number of voters who declare they will vote for the centre-right does not change as the overall sample is confident of a centre-right victory. The number of

undecided voters decreases when the overall sample does not declare any preference.

A good example of this strategy is the 2006 General Election when Casa delle Libertà (the main centre-right coalition) strongly criticized the estimate from any polls which showed the party as the loser in the race. Moreover, Berlusconi reported that on the basis of a poll commissioned by himself from an American polling institution (PSB), the Casa delle Libertà was actually leading the race. Berlusconi pursued a strong communication strategy with the purpose of keeping the attention of voters and, in particular, of undecided voters during the election. Other reasons why the increased use of polls in Italian political life is linked to Berlusconi are twofold: his formidable presence as Prime Minister over the last 20 years and, above all, how he was able to bring the lessons from other Western countries of the use of polls into the Italian context. Moreover, Berlusconi was able to ascertain when to follow and not follow public opinion as reported in the polls concerning public policies during his mandates.

This is also confirmed by Callegaro and Gasperoni (2008) who pointed out how polls have played a more significant role in Italian political life since the 2006 general elections thanks to the leader of the centre-right coalitions (Silvio Berlusconi), who undertook an intensive election campaign constantly quoting their results and, among others things, accusing Italian pollsters of being biased in favour of the centre-left (Stella 2006). Moreover, the most important factor in the increasingly significant role of polls in Italy was the change of voting system just a few months before the election. Indeed, after the *Clean Hands* scandal, the pressure to adopt a

majoritarian electoral system grew quickly in order to allow voters to choose their representatives. One of the main effects of the majoritarian system was a strong personalization of election campaigns focused on the Prime Ministerial candidates. According to Pagnocelli and Vannucci (2006), the new electoral system increases the attention given by all actors in the election campaign to the coalitions and, in particular, to their Prime Ministerial candidates¹. Consequently, the parties composing the coalitions mainly spend their resources on developing good communication campaigns in order to direct as much of their voters' attention as they can to their Prime Ministerial candidates. This provides a higher chance of getting the desired results. The effect of the new electoral system lies also in the fact that this change represents a true overturning of the previous system. In other words, the latter combined the single member, simple-majority, and proportional systems, which was actually a disadvantages for the centre-right: to a greater extent than was true for the centre- left, those willing to support one of its parties in the proportional arena were not always willing to cast their second, single-member, ballots for the coalition's candidate when the candidate was drawn from a party other than their preferred one. The new system eliminated this advantage by allowing voters, if they wished, to desert their party without having to desert the coalition; for it was to be one of closed-list proportional representation with a majority premium². Thanks

¹One consequence of the 1993 electoral reform was the greater focus on the prime-ministerial candidates in election campaigns than in the past.

²For the Chamber of Deputies, parties would present lists in multi-member constituencies and would be able to field candidates independently or in coalition with others. Voters would make a single choice of party. There were to be varying exclusion thresholds: four percent for independent parties and parties in coalitions with less than ten percent; two percent or else a percentage such as to make it the largest party below two percent for parties in coalition larger than this. The

to the pressure it created on parties to run as parts of large coalitions (as a means of reducing the exclusion thresholds they faced maximizing their combined chances of winning the majority seat premium) this system favoured the government for a second reason: the centre left was more fragmented and less cohesive than the centre-right. Given this background, polls were more important and had a higher profile than in previous elections; for among other things, competition was strongly bipolar and, thanks to the electoral system, ‘undistorted’ by local variations due to individual candidates.

2.3 Polls and election campaign

Polls and elections have an interconnected relationship and it is hard to imagine an election campaign without polls. “Poll numbers provide fodder for media coverage and election predictions, they shape candidate and voter behaviour, and they are the basis of interpreting the meaning of election outcomes” (Hillygus 2011). Since the 1960s, polls have been important for the campaign strategy especially for determining the issues to emphasize because they are very important for voters and for identifying the persuadable voters. For instance, Eisinger (2003) pointed out that polls were an integral part of the US presidential campaign because they provided a *reading* of public opinion which was independent of the media and political parties.

party or coalition achieving the largest number of votes nationally would, if they had not achieved it already, automatically be given of 340 of the 630 seats. Arrangements for the Senate were to be essentially the same with the significant difference that both the exclusion threshold and its majority premium would be applied region by region.

Gelman and King (1993) confirmed that the predictive accuracy of polls close to Election Day is related to actual voting because they are able to record observable political behaviour and, therefore, provide information on the fundamentals of the campaign.

Therefore, why is the importance of polls growing over election campaigns? The answer to this question is challenging. Scholars have pointed out that especially the US presidential election outcomes in particular are predictable over the campaign at one point at least (Gelman and King 1993, Cambell 2008). Although the electoral outcomes may change from one election to the next, at some point the level of support among voters tends to align as expected on Election Days. Ascertaining voters sentiment allows us to explain the ‘fundamentals’ of election campaigns. “The function of a campaign is, then, to inform voters about the fundamental variables and their appropriate weights; notably, the candidate’s ideologies and their positions on major issues” (Gelman and King 1993). As some scholars have pointed out, those fundamentals come directly from the campaigns. The term ‘fundamentals’ here refers to the set of economic and political circumstances which are known during the election and make the results predictable even before the eventual outcomes are stated in the polls. “The campaign effectively brings home the fundamentals to voters” (Erikson and Wlezien 2012). In other words, the voters’ final decisions are made up of several variables, which represent the fundamentals. When the campaign is not able to *bring home* the fundamentals to voters, it represents a failure of the campaign itself to fully communicate with the voters by Election Day. According to

Franklin and Jackson (1983), there are two kinds of *fundamental* variables. The first kind refers to the characteristics of voters, such as their positions on given issues, party identifications and so on. The second refers to the voters' perception of the characteristics of candidates such as their ideology and of the incumbency effect.

Another way to define the fundamentals is to focus on their persistence effect rather than on their ability to drive voters sentiment. Specifically, the fundamentals are a set of variables that cause a long-term shift in voters' preferences which lasts for the rest of the election campaign. When and how those fundamentals appear during the campaign changes even within the election itself, as well as from one campaign to the next. For instance, some of them could appear even before the official election campaign has started; others simply evolve during the course of the campaign. In light of this, there are two different assumptions in the literature. The first is that the influence of fundamentals highlights that the campaign does not matter in the end. In other words, its predictability has minimal effects. The second assumption is based on the "predictable campaign" of Campbell (2008), which refers to all those strategies employed during the campaign in order to structure partisan votes. In other words, the campaign does matter because there are substantial campaign effects even if they are cancelled out.

Campaigns influence voters through the fundamentals in three ways: learning, priming, and persuasion. According to the first way, the predictability of a campaign also implies that the voters are enlightened by campaigns through their interest in or their view of government performance (Gelman and King 1993). Some cross-

sectional research has pointed out how the fundamentals can actually last even longer than the election campaign (Stevenson and Vabreck 2000) because voters have more time to ‘learn’ about them. On this basis, fundamentals help voters to learn and stay focused on the positions of parties and candidates, as well as to increase their political attention in order to decide as Election Day approaches. In a multiparty system especially where there is lower visibility of candidates, the fundamentals of election campaigns play a crucial role. For instance, low-visibility election speeches provide information to voters in order to help them gauge the candidates’s ideology or manifesto. The second way to influence voters using fundamentals is through the knowledge that voters themselves have about to different topics.

In the literature, priming has mostly been investigated by attention to the activation of voters’ partisan predispositions (Berelson, Lazarsfeld, and McPhee 1954), racial cues (Mendelberg, 2001), and gender (Kahn and Goldenberg 1991). For instance, Vavreck (2009) has pointed out that the candidates choose the election campaign issues according to their ability to gain the attention of voters and therefore, dictate the election outcome. The third way the campaign can influence voters is through persuasion. Using Erikson and Wlezien’s (2012) words: ‘What matters most, after all, is changing voters’ electoral preference’ and to do that the campaign must persuade voters to move their decision in candidates’ preferred directions (Barfels 2006, Hillygus and Shields 2008). Despite the different ways the campaigns use fundamentals to shift voters sentiments, we cannot rule out that the campaigns’ events include many political shocks that may produce changes in voters sentiment.

In other words, all the campaign events (speeches, advertising, mobilization efforts and so on) produce inputs that voters evaluate during an election campaign. The difficulty is to estimate their effects on those evaluations and, in particular, on voters sentiment. One way to estimate could be using polls, but a part of the ‘change’ reported is also due to sampling error. In other words, the estimation is spurious and the effects deriving directly from speeches or TV debates rarely have a long-term impact. However, polls are the most common tool used over the election campaign to record the response in terms of changes in voters sentiment because the true change has a short temporary duration compared with the voters sentiment change as reported in polls. According to this, if the campaign events do have effects on voters sentiment, we should be able to observe this in poll movements over the course of the campaign.

During an election campaign, voters do not have access to full information on candidates but they do gather and increase this information over time, with the largest increase just before Election Day. In other words, voters do not have the necessary information at the beginning of the campaign to state their voting intentions. Polls ask whether they intend to vote and for whom vote and, in doing so, they provide basic information about the election race. Voters use this information about the fundamentals variables and they report their ‘likely’ vote to the pollster. However, it may be possible that responses reported in polls are biased because of differences in the information available then, and on Election Day. In other words, the discrepancy between polls and election results is also due to the extent to which

voters' information sets increase over the course of the election campaign. It assumes that voters little by little improve their knowledge of their fundamentals variables and gather all the essential information that they need by Election Day. According to this, polls at the beginning of the election campaign are the result of the degree of information available at that time. A good example of this is the work of Gelman and King (1993), where the evidence of most of change among polls is given by the change in voters' perceptions of the relative importance of their fundamentals variables, rather than the change in the value of those fundamentals.

In addition, Gelman and King (1993) have pointed out that campaign strategists use the results provided by polls carried out at the start of the campaign in order to create their strategies for the event. The latter become endogenous parts of the campaign because strategists attempt to take advantage of this information by selecting only certain groups of likely voters. However, these are short-term strategies, because closer to Election Day, respondents gather their fundamentals variables and weight them to maximize their interest or goal in the election.

In the light of the main purpose of this thesis, explaining what most causes the inaccuracy of polls over an election competition, also allows us to explain to what extent the fundamentals actually do matter and how voters sentiment has been influenced by the campaign itself.

2.4 Polls: definition

According to the literature, the poll is a tool to estimate people's perceptions of their own behaviour; what they think about themselves; or their representation in the eyes of those who are asking them. More formally, polls are a method of gathering information about a population through a list of questions asked of a sample supposedly representative of a population (Barisione and Manheimer 1999). Following Natale (2004), it is possible to classify polls into two different types on the basis of their main purpose. The *cognitive* poll aims to ascertain deep opinions in order to observe the most important issues linked with them in public opinion. The *forecast* poll aims to estimate future intentions or behaviour in the near future in public opinion. According to this, the first type is a snapshot of public opinion at the time it is carried out. The second type provide information about the likely development of intentions and/or behaviour among the public opinion. The best example of a *forecast* poll is the pre-election poll, which observes the actual level of support among voters with the purpose of 'predicting' future voting intentions, e.g. the electoral results. A poll is different from the *pseudo-poll* which is commonly used in TV-shows. Here, the host poses a generic question on the main topic of the day and the audience can answer yes or no simply by phone or by sending a text. In the light of this, the *pseudo-poll* is not considered a *proper* poll for at least three reasons. Firstly, it does not employ any statistical sampling procedures because it is based on voluntary participation in the *pseudo-poll* of the TV-audience. Secondly, those who

are following the show can answer when the question is posed by the host. Thirdly, anyone may call or send a text more than once providing an overestimation of his own opinion. The first pre-election poll dates back to 1936 when the Washington Post published the results of a poll conducted by Gallup. It is considered to be an example of the first type of poll because it used a sampling procedure that had never occurred before. Indeed, the first example of a poll was conducted in the seventeenth century with the main purpose of estimating the size of a population using the ‘count’ of a portion of the citizens. At the beginning of the eighteenth century, modern statistical science introduced the theory of probability. This event is important to the use of pre-election polls because it provided the theoretical framework of inferential procedures to follow to collect data from a small part of the population and, then, to extend the findings to the rest. An earlier version of polls is represented by *straw polls*. These were generally taken among participants in group meetings during the course of election campaigns with the main purpose of ‘counting’ the opinions or public sentiments towards a given candidate. The best (and likely first example) of *straw polls* is the questionnaire sent by the *Literary Digest* to its subscribers concerning the outcomes of the 1936 Presidential elections, to be filled in and sent back by post. However it cannot be considered a poll for at least two reasons. Firstly, its sample was composed only of subscribers to the magazine. Secondly, the delivery method meant that participation in the poll was voluntary. In other words, the questionnaire was sent by post and the subscribers were invited to fill it in and send it back by post.

A poll is generally conducted through a structured interview, where the questions posed are the same for all the sample. There are several ways to carry out a survey or opinion-polls interview:

- *Face - to - face* interview using a paper work or an electronic questionnaire stored on a personal computer (CAPI - Computer Assisted Personal Interview);
- Phone interview using the CATI system (Computer Assisted Telephone Interview);
- Post interview using the PAPI system (Paper and Pencil Interview);
- Web interview using the CAWI system (Computer Assisted Web Interview);
- Mobile interview using SMS.

The most commonly used so far is the CATI system because it is the least expensive in terms of cost and time. However, in recent years the use of the CAWI system has become increasingly commonplace and there is also an emerging literature on the methodological issues concerning the use of the web in delivering social surveys. There are at least two main disadvantages in using the CATI system. Firstly, there is a methodological issue concerning the sampling procedure because, for instance, not all the population has a landline or has agreed to be entered in the phone book. A good example of this is the work of Mokrzycki, Keeter, and Kennedy (2009), which has revealed a bias against Democratic candidates due to the exclusion of those not

included in the phone book or being in cell-phone only households. Secondly, the questions posed and the answers given must be clear and short as far as possible. Given that the interview is carried out by phone, the interviewer must be clear and fast in order to keep the interviewee's attention throughout the whole interview.

To carry out a poll *correctly*, the following criteria should be satisfied:

- The main purpose and the general inference of the poll must be clear;
- The pollster must define the sample properly. Specifically, the sample must be consistent with the survey design;
- The sample reproduces all the features of the population from which it has been drawn;
- The proportion of replacement into the sample because of respondents who are unreachable or refuse to answer must be kept under control;
- All the interviews are standardized, that is they are carried out in the same way;
- The pollster must define a limited amount of time to carry out the poll (e.g. three days or one week).

According to Barisione and Manheirmer (1999), these criteria must met over the course of in eight principal stages. Firstly, the 'unit of analysis' must be defined, that is *how* and/or *what* is being studied. The second and third stages focus on the questionnaire: the design of the questions (known as question wording) and the

testing of the questionnaire. In the fourth and fifth stages, the pollster deals with the sampling procedure and the delivery of the questionnaire. Once the interview has been undertaken, pollsters code and analyze the data collected (stage six) and they report the outcome of descriptive and multivariate analysis (stage seven). Then, pollsters disseminate the evidence and the causal interpretation of results.

According to Pagnoncelli and Vannucci (2006), polls allow us to better understand the trends in voters' support of political parties; to ascertain the behaviour of voters belonging to other parties; to measure the most important issues and the opinions about those among voters; and to identify and pursue the most efficient communication strategy.

2.5 Polls: problem

The relationship between political polling on the one hand and voter behaviour and action on the other has spawned a rich literature - one of the most influential 'anti-polling' pieces being the article in which Pierre Bourdieu claims that 'public opinion' is in fact an artifact of pollsters' attempts to measure it, and therefore a term with a significant capacity to mislead (1979). As Susan Herbst (1992) has pointed out, Bourdieu argues, among other things, that not everyone has the same capacity to produce an opinion and one can only have an informed opinion if one perceives the world in the same way as the pollsters; that some people's opinions carry more weight than others'; that in the normal course of events people form their opin-

ions in the light of their knowledge of the positions of interest groups and others, so that the neutrality and objectivity of poll questions, in avoiding mention of such positions, prevents ‘true’ opinions from emerging; that polls manufacture rather than measure opinion because pollsters’ choices of questions are made without regard to the extent to which the issues involved are meaningful or significant to the respondents themselves. Bourdieu’s stance appears to echo the view of philosophers of social sciences that actions and beliefs are logically, not causally connected and that opinions and beliefs can never be known directly but only through the actions - such as answers to pollsters’ questions - that manifest them (see e.g. Rosenberg 1988). From this point of view, it is difficult to see the sense in which ‘public opinion’ can be said to exist independently of pollsters’ attempts to capture it - but - consequently it is easy to appreciate the potential of polls as political weapons, able to create the illusion that there exists a public opinion as the mere sum of individuals’ opinions, and thereby able to legitimate the policies and power relationships that inspire them in the first place. Among more positive approaches, Ceri (1997) argues that political polls have many functions including finding out about and transmitting political demands; communicating political supply, and checking level of support, where polls have come to be considered as the detectors, *par excellence*, of what voters think and what they will vote for. In other words, polls seek to sound out respondents’ deep opinions, that is, they consolidate opinions based on the representations that cause the feelings that push them towards action, for example, voting for one party rather than another. Therefore, if polls are used to ascertain these opinions, they

can do so only when they arouse and call back to conscious awareness strong and shared feelings (McKelvey and Ordershook 1985, 1990). From this perspective, using polls to make forecasts is based on two assumptions. First, declared preferences are mechanically translated into a choice to vote for the given political party. In other words, it is as if there exists a direct causal relationship between attitude and behaviour, between declaring a preference for a political party and actually voting for it. Second, there is some over-time stability in voting choice (Page and Shapiro 1992). It assumes that in the population studied, changes of preference for political parties during the time between the interview and the election are so small as to not significantly influence the substantive accuracy of the estimation. The problem with these assumptions is that they are revealed not to be true when we compare declarations of voting intentions with election outcomes. What is the cause of the discrepancy?

There are at least two elements that stand in the way of accurate forecasting using the results of polls: the volatility of the voter over time and the distortions inherent in polling methods themselves. With regard to the first element, the tendency has been for voting behaviour to be seemingly more volatile in recent years. In the case of Italy, the growth of political polling and the publication of poll results has occurred at a time of growing movement of voters from one party to another (at least within the same coalition) caused by changes in the bases of voter behaviour. In particular, where once the latter was heavily influenced by those factors underlying the so-called ‘vote of belonging’ (Parisi and Pasquino 1977) - voting tending

‘to be the expression of an automatic, unreflecting, subjective identification with the political party seen as an entity organically linked to the social group to which the voter belonged’ (Bull and Newell 2005) - voting is now more likely to be based on specific preferences (for agendas, themes, and so on...) underlying the so-called ‘opinion vote’ with the voter changing party from one election to the next in accordance with these preferences. In addition, there is another kind of vote, the so-called ‘trade vote’, whereby the voter supports a candidate in the expectation that the candidate will give her something, or do something specific once elected (for example, finding her a job). Under these circumstances, the political party wants to know in advance how large the percentage of ‘undecided voters’ is, that they might control this through the ‘trade vote’. The polls are, then, used both as a mirror of public opinion, and as a tool by which to manipulate it.

According to Natale (2004), another source of error in carrying out polls comes from the difficulty of properly estimating what people think without distorting this eventually. Pagnoncelli and Vannucci (2006) have pointed out that there are at least three factors which affect the forecast. Firstly, the interviewee tends to project his own voting intention on a large scale. Secondly, the undecided voters may be affected by the bandwagon effect because predicting that a given political party will win is commonplace across the media. Thirdly, the voter is less likely to lie and declare his real voting intention when he believes that it is also the voting intention of the majority of voters. All of these factors have effects, such as distorting real voting intentions because they function as a forecast of the winner; producing an

‘error’ of expectations; the failure of polls (disagreement between poll results and the true voting intentions).

According to the literature, polls may fail when used to predict election results for a variety of reasons including: end-of campaign changes in voting intentions; differential voter turnout; the effect of polls themselves on voting behaviour (Oskamp and Schultz 2005). However, there are also three groups of significant methodological problems underlying the use of polls to predict the outcomes of elections: sampling error, design error, and house effects (Converse and Traugott 1986; Erikson and Tedin 2011; Roper 1984). Regarding the first, one of most significant problems is ‘non response’ - a problem whose significance derives from its ambiguous quality and, therefore, the role it plays with respect to the randomness and representativeness of a sample. Non-response refers to an ‘obscure area’ covering: voters who are not at home or do not reply when telephoned; voters who refuse to answer; the undecided voter. For many scholars, refusal to reveal one’s voting intentions and genuine indecision about the choice have been given heightened significance in the Italian case thanks to the dramatic political and party -system change of the 1990s - which saw the appearance of many political forces that were new and therefore unfamiliar to many voters (Crespi 1988). The problem lies in the fact that the distribution of the voting choices of non- respondents is in all probability different from the distributions among respondents. The responses of the latter cannot, therefore, be projected onto the sample as a whole. When someone is conducting a poll, one of the most tricky moments comes in attempting to gain the cooperation of all people

included in a sample. The randomness and the representativeness of a sample require that every individual in the population has the same known probability of being chosen as a respondent, and non-response influences the two essential requirements of samples significantly. There are two biases to take into consideration: ‘design bias’ (you might not find all the people included in your sample at home) and ‘participation bias’ (even if you find them in, it is not certain that they will agree to be interviewed). If the random sample requires that every individual has the same known probability of being included, then these biases ensure that a sample is really random only at the moment of extraction of individuals. When the interviewee refuses to answer or is not home, the pollster replaces her with one of a list extracted from the same population and weights the answer gained by the number of non-responses. These statistical procedures are based on the assumption that there is a sufficient equivalence between the individual replaced and her replacement - and yet they represent one of the major causes of the failure of polls to predict election outcomes. “The greatest difficulty of all is the fact that election itself is not a census, but an application of the sampling principle. Every poll is therefore a sample of a sample (Crossley 1937)”. According to Crossley (1937), the exact population to whom pollsters try to impute the information given is unknown: we do not know who will vote on Election Day. Another problem linked with the sample is the selection of likely voters. Crespi (1988) has pointed out how the forecast changes on the basis of the method employed to define the *expected voters*. A good example is represented by the work of Erikson, Panagolopoulos and Wlezien (2004)

where the 19-point change in support from Gore to Bush over the 2000 Presidential campaign is due to the artifact of Gallup's likely voter screen. Indeed, it is common among polling institutions to use self-reported measures of voter registrations or voting histories rather than more up-to-date scholarly research explaining political participation. The volatility of polls may be reduced by aggregating poll predictions. Therefore, pooling polls improves the accuracy of polling estimates because a larger sample size has a smaller margin of error. However, the simple aggregations made by averaging all the available poll readings ignores important effects like the *house effect*. In addition, it assumes that sources of error for each poll will cancel each other out, but where the bias works in the same direction, the aggregation will not reduce bias.

Regarding design error, there are at least two causes: timing and the question wording. Firstly, if a question is asked too soon after an event, it may result in measuring an initial or knee-jerk reaction and not a more considered opinion, the latter being the purpose of polling (Lang and Lang 1984). Secondly, question wording concerns both the form in which the question is cast (that is, open or closed questions) and the choice of words for each item (Lang and Lang 1984). Generally, polls use closed questions, which require a selection from a fixed set of answers. Within the category of closed questions, there are various forms, styles, and a number of alternatives offered such as the explicit inclusion - or otherwise- of 'don't know' or 'no opinion' as response categories. Regarding the choice of words, there are a number of statement forms, variation amongst which tends to produce different

results as well as their own inherent problems. A common form is the use of the Likert statement with which respondents are asked to agree or disagree. There is a predisposition on the part of people to agree with a statement in particular if the statement regards something they have little knowledge about. The second related form is known as the ‘yeasay’ effect, where similarity between the statements may induce respondents to reply yes to unidirectional phrasing. Whichever form is used, common wording issues can compound problems: for instance, the double negative statement, which causes confusion and uncertainty in the respondent. Crespi and Morris (1984) have pointed out that the question order produces different estimates of support for a given candidate.

The house effect refers to biases caused by methodologies employed by different polling institutions. Many important academic works show that surveys can vary across houses due to differences in question wording, target populations, data collection mode, interviewer training, and procedures for coping with refusal (Converse and Traugott 1986; Lau 1994; Crespi 1988; Erikson and Wlezien 1999). According to this, poll results vary from one day to the next in part because different houses conduct them on different days. Therefore, this variation may be seen as an artifact of the polling process rather than a true reflection of voting intention volatility. Other works have pointed out how pooling together estimates from the different polls produces a more accurate estimate, which limits the impact of both random variation between polling samples and systematic effect generated by the house effect (Erikson and Wlezien 1999; Jackman 2005; Pickup and Johnston 2008).

Pagnoncelli and Vannucci (2006) have introduced the idea of ‘*illusory variance*’ of polls. In other words, polls are conducted by different polling houses so that what changes from one day to the next is not the level of support for parties among voters but the various methods employed by polling houses to ascertain the level of support.

2.6 Research question and hypotheses

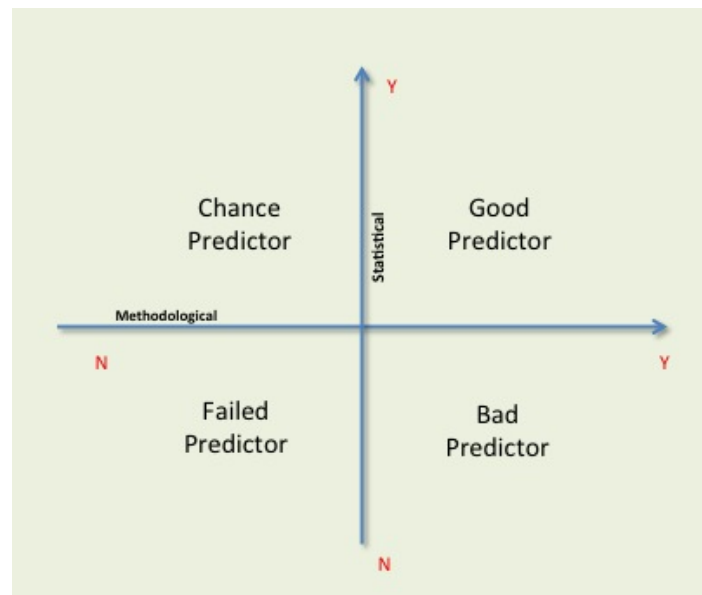
With this in mind, accuracy here refers to the correspondence between poll results and the actual election outcomes. Despite the fact that many academic works have pointed out that polls are not a method to forecast election outcomes, they are still used both by academics and pollsters to predict voters’ behaviour (Erikson and Wlezien 1999; Wlezien et al 2013). Therefore, the principal question to address is:

- Under what conditions are polls inaccurate as predictors of voters’ behaviour?

The last two decades have experienced many cases of polls’ failure to accurately predict the outcome of elections as in the British General Election of the 1992 and 2015 (Jowell, Hedge, Lynn, Farrant, and Heath, 1993); the 1998 Quebec Election (Durand, Blais, and Vachon, 2001); the 2002 and 2007 French Presidential Election (Durand, Blais, and Larochelle, 2004, Durand 2008). According to these studies, we know pollsters get it wrong mainly for methodological reasons (they arguably create as much as measure “public opinion”, sampling, question wording), and/or socio-

political reasons (electoral system; characteristics of parties), and/or sociological reasons (voters' change their minds, socio- demographic characteristics) (Durand, Deslauries, Goyder, and Foucalt 2010). What we know less is which of these various factors are the most significant ones in causing inaccuracy. As already pointed out, there is not existing academic work studying polling in Italy in terms of their predictive accuracy over the last ten years. It is important to shed light on accuracy because although polls can only measure opinion at the time they are taken, they are used by pollsters and academics to predict voters' future intentions. They therefore become an integral part of election campaigns themselves, so shedding light on the conditions under which they will be more or less accurate will also help us to understand election campaigns better.

Figure 2.1: Different types of poll performance on the basis of their accuracy/inaccuracy



With this in mind, there are four different types of accuracy/inaccuracy, as follows (see figure 2.1):

1. Chance Predictor: the poll is statistically accurate but methodologically not robust;
2. Good Predictor: the poll is statistically accurate and methodologically robust;
3. Bad Predictor: the poll is statistically inaccurate but methodologically robust;
4. Failed Predictor: the poll is statistically inaccurate and methodologically not robust;

For the purpose of this thesis, we will analyze cases where statistical inaccuracy (3 and 4) occurs in order to explain the conditions under which polls could be considered ‘inaccurate’ predictors of voters’ behaviour.

The main hypotheses are:

- **H1**: The inaccuracy of polls is caused by the house effect;
- **H2**: The inaccuracy of polls is caused by changes of voters intentions between the time the polls are carried out and Election Day;

In order to test these hypotheses, two analyses will be carried out. Firstly, to test the hypothesis of voters changing their mind as at least a partial source of error, we need to look at the trend in true voters sentiment over the election campaign assuming that the level of support for a given party is a function of yesterday’s

level of support. If it is not, it suggests that voters are influenced by something else that must have caused the ‘change’, for instance the house effect affecting polling responses. Secondly, to test the first hypothesis, we will analyze the variance of poll readings and their accuracy values using a well-established econometric method.

Chapter 3

Methodology

3.1 Introduction

As explained in the previous chapter, the use of polls to *forecast* an election is based on two assumptions. Firstly, the declared preferences are mechanically translated into a choice to vote for a given political party. Secondly, there is some stability overtime in voting choices. In other words, the change of preference for a given political party between the time of the interview and the Election Day is so significantly small as not to influence the accuracy of the estimation. The main purpose of this thesis is to investigate what are the causes of inaccuracy in polls and to do that, we have derived two hypotheses from the literature:

- **H1** the inaccuracy of polls is caused by the methodologies employed by different polling houses, the so called ‘house effect’;

- **H2** the inaccuracy of polls is caused by voters sentiment change during the election campaign.

Moreover, the evidence provided by the analysis will also give information about what has the greatest impact on inaccuracy in polls' predictions. Before testing these hypotheses, an analysis of the accuracy of polls over the last three Italian general elections will be carried out. By using well-established accuracy measures, we will be able to provide evidence of the number of polls classified as inaccurate and the overall degree of error among poll readings over the three elections. Moreover, we will also estimate the timing of accuracy in order to specify whether there are more polls classified as accurate closer to or farther away from Election Day over all the elections considered. Then, we will test the two hypotheses using the two models proposed by Erikson and Wlezien (1999) and their revisions. Therefore, this chapter is devoted to explaining all the methods employed in this thesis. Accordingly, in the first section we will discuss the accuracy measures proposed so far. The second section will describe the two main approaches to estimating the house effect. The last section will introduce the autoregressive model and its application to estimate the voters sentiment changes. In addition, all sections will describe how to revise these procedures in order to fit the Italian case.

3.2 Accuracy Measure

Polls play an important role during election campaigns and this may be larger in some elections than others. The potential influence of polls over the course of the campaign is always present and it means that their design and accuracy is important. Indeed, the most common method used to estimate the predictive accuracy of poll readings with regard to voting intentions is to compare the polling estimate for a given (preferably the leading) party, or the difference between the competing parties, to the election results. Poll accuracy measures essentially compare intentions to vote for a particular candidate or political party with official voting results. The former sets of data are drawn from polls before elections, from samples of voters with different question wording. The official voting results, otherwise, are based on actual expressions of preference. Therefore, this comparison is possible only if two main assumptions are satisfied. Firstly, the data drawn from polls are respondents' true voting intentions or there is almost perfect agreement between their declaration and their actual voting intentions. Secondly, if there is any difference between the polling data and actual votes, these will cancel each other out in the final count (Geys 2006).

An alternative method is to evaluate the performance of polls throughout the election campaign the main purpose being to estimate the accuracy of polls at the time they are taken.

In the academic literature, most statistical measures of accuracy are based on

the first measure proposed by Mosteller (1949). He introduced eight different methods to quantify the accuracy of polls, six of them being based upon the estimated proportion of the vote received by the front-runner or the differences in the estimated margin between the leaders. The most commonly used methods (and the ones he himself preferred) are methods three and five. The first captures “the error by averaging the deviation in percentage points between predicted and observed results for each party (without regard to sign)” (Mosteller 1949). The second uses “the difference of the oriented difference between predicted and the actual results for the two major candidates” (Mosteller 1949).

Since then, there has developed a significant literature which has reviewed these measures. For instance, one of Mitofsky’s works enhanced those measures by addressing the problem of the undecided voters proposing four allocation techniques (Mitofsky, 1998). The main conclusion of his work on the Presidential election in 1996 is that the proportional allocation of undecided voters based on the final results (technique 1) is the most consistent with results when comparing different polls. Moreover, Mitofsky’s work confirmed that methods three and five yield a better evaluation of the accuracy of polls. Over time, the two methods have been reviewed on the basis of aims of research or features of elections. A good example is Jowell et al.’s (1993) work on the 1992 British General Election based on Mosteller’s method three or Curtice’s (1997) work on the 1997 British General Election using the Mosteller’s method five. However, the most extensive work has been conducted by Crewe (1997), who applied methods one, three, and five to assess the accuracy

of polls from 1945 to 1997 over the British General election campaigns. One of the main conclusions of his work is that the mean deviation between the average forecast for each party's vote share and the actual vote share is the best measure to estimate the accuracy of polls. In 1996, Lau introduced another measure of accuracy, which does not take into account the electoral results. Specifically, it is the difference between a specific poll and "the average of all available polls results (weighted by sample size) except the poll whose accuracy is being judged" (Lau, 1994). One of his main conclusions and contributions to the literature on accuracy measures is that the report of margin error based on the survey size does not provide correct information on the accuracy of polls in tracking voters' true voting intentions. In addition, he strongly advised the introduction of a new measure based on the response rates for each party or candidate or coalition rather than on the margin error. Durand (2002) applied Lau's measure in order to estimate the biases among polls towards the Quebec Liberal party in the 2000 Canadian Federal Election. Specifically, she revised Lau's measure using the difference between the estimate of each poll and the estimate from a time-series analysis. In other words, Durand created a time-series analysis using the daily poll average and then, she plotted them on a chart including 95% of margin trend lines. This procedure allowed her to compare each poll to the average at a specific point in time to assess its accuracy (Durand, 2002). Her main finding was that at national level, polls in terms of statistical bias underestimated the performance of the Quebec Liberal Party.

The main disadvantages of the measures proposed so far are that none of them

deals with the sampling error of polls and the allocation of undecided voters, which are important factors when considering poll's predictive failure. To solve these disadvantages, in 2005 Martin, Traugott, and Kennedy proposed a new measure of accuracy called A to obtain a measure unaffected by the size of the undecided voter category and which takes into account the sampling error. This is a natural logarithm of the odds ratio between the outcomes in a poll and the outcomes of the election:

$$A = \ln \left[\frac{(r/d)}{(R/D)} \right] \quad (3.1)$$

where r and d are the number or percentage of polls respondents who favour the Republican and Democratic candidates whereas R and S are the actual number or percentage of voters cast for the Republican and Democratic candidates. According to this, a significantly negative (positive) value indicates that the poll underestimated (overestimated) support for the Republican Party. A value equal to 0 reflects a perfect agreement between the poll and the actual election results. The choice of natural logarithm is based on the desire to create a measure that is symmetric around zero and then to simplify the calculation of variance, formally expressed as follows:

$$Variance(A) = 1/(n \cdot r \cdot d) \quad (3.2)$$

where n is the number of respondents to the polls. This new measure has a

number of advantages such as allowing a comparison of accuracy across elections. For the purpose of this thesis, the most important advantage is that it produces a signed statistic rather than an absolute value. In other words, it is informative of how poll estimates differ from the actual outcomes in terms of direction. A is less vulnerable to variations in the size of the undecided category than are other measures, based as it is on relative, rather than absolute distributions of voter preferences. However, like others, it is slightly affected by variations in the size of the category of the undecided and, therefore, by fluctuations in the way pollsters handle these voters. One weakness of A lies in the fact that it has been designed with the American political system in mind, and therefore only “evaluates the accuracy of a poll’s forecast of the split between the two major party candidates in a partisan election” (Martin, Traugott and Kennedy 2005). In Italy, there are more than two parties in competition, and in recent years, the evolution of the Italian system has seen the emergence of party coalitions rather than individual parties as the representatives of the main political (left-right) cleavage in the country. Indeed, in a scenario with n -parties, the formula 3.1 can be rewritten as follows:

$$A'_B = \ln \left[\frac{(b/(c + d + \dots + z))}{(B/(C + D + \dots + Z))} \right] \quad (3.3)$$

where b and B are the poll prediction and actual electoral results for party B, c and C are the poll prediction and actual electoral results for party C, and so on¹.

¹Accordingly, the formula 3.2 of variance is revised as follows:

$$Variance(A) = 1/(n \cdot b \cdot c \cdot d \cdot \dots \cdot z) \quad (3.4)$$

However, in this version A'_B does depend on the reference party, where a positive value of A'_B indicates an overestimation for the reference party whereas a negative value indicates an underestimation for the reference party. In order to avoid this dependency, Arkheirmer and Evans 2014 rewrite formula 3.3 as follows:

$$B = \frac{\sum_{i=1}^k |A'_i|}{k} \quad (3.5)$$

where k is the number of parties.

To correct the inflation due to the inaccurate polls for small parties which gain a small share of the vote, Arzheimer and Evans propose a weighted version of B (B_w) using the relative share of votes of total vote. The value of B and B_w comprises the degree of error in the poll's estimate: the higher its value, the higher the error in the estimate. However, to test the null hypothesis of no bias, Arzheimer and Evans employ two statistical tests of χ^2 and G^2 using the conventional criterion of $p \leq 0.05$. Unlike A measure, B_w does not classify polls as accurate or inaccurate but provides the important information about the overall error in each poll reading. However, Castro and Tomaselli (2015) highlighted the high sensibility of this measure to the number of parties/coalitions taken into account in its computation. Therefore, in order to reduce the likely error given the inflation derived from the presence of small parties in the race in this thesis only the B_w will be employed in analysis .

Given that the main purpose of this thesis is to investigate the main causes of

where n refers to the number of respondents, b is the poll prediction for party B, c is the poll prediction for party C, and so on.

inaccuracy in Italian polling, we employ two statistical measures of the predictive accuracy of polls on the basis of the information provided by them. Specifically, we firstly employ the A' measure in order to quantify the number of polls classified as inaccurate. Moreover, this measure also estimates the over- or underestimation of each coalition over the three election campaigns. Secondly, we will employ the new measure B_w in order to quantify the overall degree of error in Italian polling. Both the measures have the great advantage of being used as dependent variables in dynamic models of poll accuracy. As will be explained in the next sections, the two indexes (A' and B_w) will be included in the multivariate regression model in order to estimate the house effect in Italian polling, which represents one of the hypotheses of this thesis.

3.3 House Effect Measure

The house effect refers to biases caused by methodologies employed by different polling houses. Many important academic works show that surveys can vary across houses due to differences in question wording, target population, data collection mode, interviewer training, and procedures for coping with refusal (Converse and Traugott 1986; Lau 1994; Crespi 1988; Erikson and Wlezien 1999). According to this, poll results vary from one day to the next in part because different houses conduct them on different days. Therefore, this variation may be seen as a result of the polling process and not as a true reflection of voting intention volatility.

Other works have pointed out how pooling together estimates from the different polls produces a more accurate estimate. This procedure limits the impact of both random variation between polling samples and systematic effects generated by the house effect (Erikson and Wlezien 1999; Jackman 2005; Pickup and Johnston 2008). These works use different models to ascertain the impact of the house effect in polls. Indeed, there are two main streams of analysis used to estimate the house effect: frequentist and Bayesian models. The former follows the model proposed by Erikson and Wlezien in 1999, regressing the poll readings in a set on survey houses ($N - 1$) and z dummy variables for each day with at least one poll reading. This is formally expressed as follows:

$$V^{i,j} = \sum_{z=1}^Z \beta_z i_z + \sum_{n=1}^{N-1} \gamma_n j_n + \mu \quad (3.6)$$

where V refers to the poll series, i refers to the day the polls appeared, and j refers to polling institution. The house effect is comprised by the coefficients of day dummy variables. In addition, they employ the well-established procedure by Cleveland (1979) and re-discussed by Beck and Jackman (1998) and Jacoby (1997): lowess. The latter allows computation of new values for each time point on the basis of the outcomes of regression using a given number of data points. The temporal distance from the points in question creates a weighted prediction value from the regressions, which are essential to compute the new values. The robust locally weighted regression (known as lowess) enhances the information provided by scatterplot. Assuming points of scatterplot are (x_i, y_i) , $i = 1, \dots, n$, the smoothed

points are (x_i, \hat{y}_i) , where \hat{y}_i is the fitted line value at x_i and represents the location of Y for $X = x_i$. Specifically, (x_i, \hat{y}_i) shows the location of the distribution of the variable on the vertical axis (Y) given that the value of the variables on the horizontal axis is $(X = x)$. The smoothed regression has been drawn for data formally expressed as follows:

$$y_i = g(x_i) + \epsilon_i \quad (3.7)$$

where g refers to the smooth function and ϵ_i refers to random variables with mean 0 and constant scale. According to this, \hat{y}_i estimates $g(x_i)$. Therefore, points surroundings (x_i, y_i) are formed by \hat{y}_i . The use of smoothed point allows us to employ a nonparametric regression of Y on X. In other words, the lowess portrays the fitted value at x_k represented by “a line fit to the data using weighted least square where the weight for (x_i, y_i) is large if x_i is close to x_k , and small if x_i is not close to x_k ” (Cleveland, 1981). To do that, the bandwidth or the percentages of time points in the full series must be established in order to generate smoothed values. Specifically, the increase of surroundings points is determined by f which increases the smoothness of smoothed points (x_i, \hat{y}_i) . The main driver in picking bandwidth of f is a value as large as possible, which both minimizes the variability in the smoothed points and does not distort the trend of the data. Indeed, assuming $W(x)$ is the weight function which decreases for increasing nonnegative x , then the weights $w_k(x_i)$ decrease as the distance of x_k increases from x_i . In other words, points closer to x_i play a significant role in determining \hat{y}_i . Otherwise, all far away

points are less significant. Formally, h_i is the distance for each i from x_i to r -th closer neighbour of x_i . Therefore, h_i the r -th smallest number among $|x_i - x_j|$ for $j = 1, \dots, n$. The weight function (W) must have the following properties:

1. $W(x) > 0$ for $|x| < 1$;
2. $W(-x) = W(x)$
3. $W(x)$ is a nonincreasing function for $x \geq 0$
4. $W(x) = 0$ for $|x| \geq 1$

where $0 < f \leq 1$ and r is a fn rounded to the closer integer. Consequently, weights ($w_k(x_i)$) are defined for all x_k , $k = 1, \dots, n$ using the weight function W for each x_i . By centering W at x_i , the point at which W first becomes 0 is the r -th closer to the neighbour of x_i . Therefore, the fitted value \hat{y}_i at each x_i is the fitted value of a d th degree of polynomial fit to the data using weighted least squares with weights $w_k(x_i)$ (Cleveland 1979). Erikson and Wlezien (1999) pointed out that one of the advantages of using this procedure is that it follows the data closely.

In a similar vein, Panagopoulos (2009) ascertains the predictive accuracy of poll readings using a multivariate regression analysis where poll methodologies are explanatory variables. Specifically, he includes in the model information such as likely voters and the delivery method employed by polling houses as independent variables. In addition, he employs both the OLS and Probit models using the same variables. These models do not provide different evidence in terms of the statistical

significance of coefficients. However, the sign of some coefficient changes direction on the basis of the model used. For instance, using the OLS regression the registered voters (likely voters) has a negative relationship with the predictive accuracy index (A) across the 2008 US Presidential poll readings. Conversely, using the Probit regression, this relationship becomes positive. However, the main conclusion is that the predictive accuracy of polls is mainly affected by likely voters and delivery methods employed by different polling houses.

The second approach has been proposed by Jackman's works on the 2004 Australian federal election published in 2005. Since its appearance, the literature has witnessed a growing use of Bayesian models to estimate the house effect as well as voter sentiment change. This model assumes that each poll estimates the level of support (y_i) of political parties with a standard deviation that is a function of y_i and the poll's sample size, formally written as follows:

$$y_i \sim N(\mu_i, \sigma_i^2) \quad (3.8)$$

Due to each polling institution j_i produces n polls on a given field date t_i , the formula 3.8 is rewritten as follows:

$$\mu_i = \alpha_{ti} + \sigma_{jt} \quad (3.9)$$

and α_{ti} is the parameter estimate used in order to capture the house effect. To estimate voters sentiment change, Jackman's model assumes that party support

follows a simple random walk model with a normal distribution, formally expressed as:

$$\alpha_t \sim N(\alpha_{t-1}, \omega^2), t = 2, \dots, T \quad (3.10)$$

$$\alpha_t \sim Uniform(0.4, 0.6) \quad (3.11)$$

In other words, this model assumes that the level of support for a party or coalition is given by the level of support of the previous day except for random shocks deriving from a normal distribution with mean zero and standard deviation ω . In addition, and especially to estimate the house effect, there is the constraint of actual election outcomes that must be applied. “This is an important constraint; without being able to anchor the estimated levels of Coalition support to actual election outcome, the model unravels, it being impossible to simultaneously estimate underlying levels of support for the Coalition and house effect. Accordingly, the model cannot be used for ‘real-time’ tracking over the course of the campaign unless we impose a priori restrictions on the house effect” (Jackman, 2005:509).

Pickup and Johnston (2008) use both approaches in order to address sampling error and house bias during the 2004 US Presidential trial heats. Specifically, they employ the Erikson’s and Wlezien’s model as a starting point to remove the house bias from the voting intention as estimated by polls. Given that this model does not remove the noise from the sampling error, they apply the Kalmar filter to further

filter the estimate of voting intentions using a state-space approach. In other words, the house-adjusted series is set in a state-space form where the measured opinions are the product of two unobserved components estimated by Bayesian analysis (Pickup and Johnston 2008).

3.3.1 Model and Revision

Given the purpose of this thesis, we opt to employ both the model proposed by Erikson and Wlezien (1999) and Panogopoulos (2009) in order to estimate how much of the inaccuracy is due to variance of days and which methodologies cause most error in Italian polling respectively. Given that Erikson's and Wlezien's model has been developed on the basis of the American system, we will run the analysis for each coalition in order to investigate the house effect in Italian polling. Doing so, we will estimate the extent to which the house effect affects the accuracy of polls' estimate of the support for each coalition as well as the overall accuracy of poll predictions. Formula 3.6 is rewritten as follows:

$$V_B^{i,j} = \sum_{z=1}^Z \beta_z i_z + \sum_{n=1}^{N-1} \gamma_n j_n + \mu \quad (3.12)$$

where $V_B^{i,j}$ is the polls series for B party/coalition, i refers to the day the poll readings appeared, and j refers to the polling institution. This model is based on the consolidated tradition of application in econometric analysis. In addition, we carried out the analysis using the predictive accuracy indexes A' for each party/coalition

and with the main purpose of estimating its relationship with the variance of day and polling house. The model is formally expressed as follows:

$$A'_B = \sum_{z=1}^Z \beta_z i_z + \sum_{n=1}^{N-1} \gamma_n j_n + \mu \quad (3.13)$$

where A'_B refers to the predictive accuracy index for B party/coalition, i refers to the day the poll readings appeared, and j refers to polling institution. This model will be also applied using the predictive accuracy indexes A and B_w to estimate how much the overall error is affected by the variance of days and polling houses². Accordingly, we expect inaccuracy in Italian polling to be made up of significant high *Adjusted R*² and the statistical significance of the regression model using the ANOVA test. In addition, the smoothed versions (Lowess) of the polls series provide a better picture of how any movement of the series is caused by the house effect and/or voters sentiment change.

In order to estimate which methodologies employed by polling houses affects the predictive accuracy of Italian polls the most, we follow the multivariate regression model employed by Panogopoulos (2009). Unlike his approach, dependent variables employed in this analysis are the accuracy measures A , A' , and B_w . On the basis of Italian law, pollsters must publish a form along with the poll results on the website managed by the Department of Information and Publishing, which contains infor-

²By employing the A and B_w measures as dependent variables, model 3.13 is rewritten as follows:

$$AI = \sum_{z=1}^Z \beta_z i_z + \sum_{n=1}^{N-1} \gamma_n j_n + \mu \quad (3.14)$$

where AI is the accuracy index series.

mation about the sample, the delivery method, the buyer, and where its results have been disseminated (media). To test the hypothesis on the house effect, a multivariate model will be employed using all the information provided by Italian pollsters on methodologies employed, the buyer, and media. Accordingly, the methodologies taken into consideration are sample and delivery method. Specifically, we include in the model a dummy variable for random sample and a dummy variable for a sample other than a random one. We expect a negative relationship between the random sample and the degree of error estimated by the three accuracy measures. In other words, the use of random samples decreases the error in poll readings. Concerning the delivery method, we include in the model a dummy variable for each of two methods employed: CATI and CAWI. The main expectations are a positive relationship between both of them and the dependent variable. For instance, some studies show there is a growing number of cell-phone only individuals and, therefore, they might not be reachable using the CATI system (Keeter, Dimock, and Christian 2008). In addition, we will also include the information about who commissioned the poll (buyer) and where its results have been disseminated (media). Specifically, we include in the model dummy variables for each of the actors who commissioned the polls (media, political, and polling houses) and dummy variables for each section of the media where its results have been disseminated (TV, newspaper, and internet). For each of the methodologies employed, we expect a different relationship with the accuracy measures. A positive relationship is expected with the media and political commissioners. Conversely, a negative relationship is expected with the rest of the

variables. In addition, we include in the model a variable on difference estimated by polls between the two major parties/coalitions (DCEP). According to the Italian election results, our main expectation is that there is a positive relationship with the dependent variable. In other words, the higher the difference between the two major parties/coalitions, the higher is the error estimated in polls.

The model is formally expressed as follows:

$$AI^{(i,j)} = \alpha + \sum_{z=1}^Z \beta_z M_z^{(i,j)} + \beta_{k+1} DCEP^{(i,j)} + \mu \quad (3.15)$$

where AI is the accuracy index series, i refers to the day when the poll was published, j refers to the polling institution, $M^{i,j}$ is a given methodology employed by the j -th polling house, and $DCEP^{i,j}$ is the difference between the two major parties/coalitions. The house effect is given by the coefficient of explanatory variables. In addition, the use of this model allows us also to estimate the methodological robustness of polls in line with the types of accuracy/ inaccuracy cases described in the previous chapter (see figure 2.1).

3.4 Voter Sentiment Measure

Voters sentiment change between the time interviews are carried out and Election Day may be responsible for the failure of polls accurately to predict election outcomes. Using panel data, Hillygus and Shield (2009) showed that more than 40% of respondents change their voting intentions at least once over the course

of an election campaign. In 2002, Erikson and Wlezien analyzed the dynamics of polls, attributing to sampling error (as well as the shocks brought about the real movements, especially at the beginning of the election campaign) 50% of variability among polls. The second hypothesis of this thesis is that the inaccuracy of polls is due to change in voters sentiment. The previous section explained that using Jackman's model it is possible also to estimate the change in voters sentiment beyond the house effect. As we prefer to employ a well established econometric model to estimate the house effect, we will analyze the voters sentiment change over the last three Italian general elections again using Erikson and Wlezien model (1999). Before applying this model, it is necessary to undertake an analysis of variance of the poll results in order to examine how much of the observed movement over the time is a true movement of public sentiment rather than sampling error. To do that, we will estimate the observed variance, the sampling error, error variance, true variance, and reliability. The observed variance is the variance of the poll results themselves. The sampling error is formally expressed as follows:

$$\sqrt{p * (1 - p) / N} \tag{3.16}$$

where p is the proportion voting for a given party and N is the number of respondents. The error variance is the average of error. Accordingly, the true variance is the difference between the observed variance and error variance. Instead, reliability is the ratio between the true variance and the observed variance. The last two mea-

sures comprise the presence of voters sentiment change over the election campaign. According to this, when the sampling error (and thus, the error variance) is higher than the observed variance, it possible to argue that the inaccuracy of polls is due to sampling procedures applied by polling houses. Otherwise, the amount of true variance and reliability reflects the extent of voters sentiment change over time. As for the accuracy and house effect measures, we will run this analysis for each coalition in order to estimate the voters sentiment change for each of them. In addition, if the analysis of variance confirms that the inaccuracy of polls is not only caused by sampling error for each coalition, then we will apply a sophisticated model to investigate those movements. Otherwise, we will not apply the model for the given party/coalition.

How do we estimate voters sentiment change over an election campaign? As with the house effect, we follow the model proposed by Erikson and Wlezien (1999). Specifically, they assume when pooling together poll results, the series follows an autoregressive process of order 1 (AR(1)). Before proceeding to explain the full model, it is useful briefly to describe what an autoregressive process is. The latter is a stochastic process where the time series is a linear function of its past values plus a *white noise*. In other words, the model works like a regression where the explanatory variables are the past values of the dependent variable, formally expressed as follows:

$$y_t = \varphi_1 y_{t-1} + \dots + \varphi_p y_{t-p} + \epsilon_t \quad (3.17)$$

where ϵ_t refers to *white noise*. The latter may be interpreted as the error in a regression model, which is the difference between y_t and its conditional mean. However, *white noise* is a stochastic process composed of an infinite number of random variables with mean 0 and constant variance:

$$E(\epsilon_t) = 0 \quad (3.18)$$

$$E(\epsilon_t^2) = V(\epsilon_t) = \sigma^2 \quad (3.19)$$

$$\gamma_k = 0 \quad \text{for } |k| > 0 \quad (3.20)$$

The random variables are not correlated with each other, but this does not mean that they are independent. This property of *white noise* allows that the conditional mean is not a linear function of the past and, therefore, it is a stochastic process which does not have persistence. Indeed, a time series is characterized by the presence of ‘memory’ across time. A stochastic process is roughly defined as a “statistical phenomenon that evolves in time according to probabilistic laws” (Chatfield, 2004). Mathematically, it is a long collection of random variables with a *memory* based on the degree of connection between those variables. The stochastic process must have the following properties:

- it is possible to define a density function of process ($f(..., x_{t-1}, x_t, x_{t+1}, ...)$);
- it is possible to marginalize the density function for each subset of its components. Accordingly, there are defined marginal density functions for each x_t ,

but also for each couple of elements (x_t, x_{t+1}) , and so on;

- if the density function has moments, then $E(x_t) = \mu_t$, $V(x_t) = \sigma_t^2$, $Cov(x_t, x_{t-k}) = \gamma_{k,t}$ and so on;
- and it is possible to define the conditional density function (and its moments).

However, a stochastic process may be stationary or ergodic. The former is *strictly* stationary when the distributional characteristic of marginal subsets are constant across time. Specifically, let k be a stochastic process and its subset $W_t^k = (x_t, \dots, x_{t+k-1})$. If the density function does not depend on t and W_t^k distribution is equal to W_{t+1}^k , W_{t+2}^k and so on, then the process is strictly stationary when this invariance occurs for each k . Conversely, a stochastic process has a *weak* stationary process when for all the double random variables $W_t^2 = (x_t, x_{t+1})$ have first and second moments constant across time. Accordingly, there are second crossed moments $E(x_t \cdot x_{t+k})$ for each k and they do not depend on time t . The ergodic property refers to the limited memory of process. In other words, the presence of persistence is unremarkable not characterizing the process even if it is long. Therefore, the memory in an ergodic process is weak across time and it is affected or the size of sample increases. Indeed, for this kind of process it is possible to use the information obtained across time in order to infer the characteristics (known as ergodic theorem). According to these properties, let AR(1) be a stationary process

with constant mean (μ), therefore:

$$\mu = E(y_t) = \varphi E(y_{t-1}) + E(\epsilon_t) = \varphi\mu \quad (3.21)$$

This is true:

- if $\mu = 0$ and it is true for any value of φ ;
- if $\varphi = 1$ and it is true for any value of μ and the mean of process is undermined.

Therefore, the process has a *unit root*, because the value of z where $y(z) = 0$ is

1. Conversely, if a process is a moving average (MA) and, then, $|\varphi| < 1$:

$$y_t = (1 + \varphi L + \varphi^2 L^2 + \dots)\epsilon_t = C(L)\epsilon_t \quad (3.22)$$

where L refers to the grade p and MA with $\theta_i = \varphi^i$, which has a mean equal to 0, the $E(y_t) = 0$. To compute the second moment, let us assume that the variance of *white noise* ϵ_t is equal to σ^2 and V is the variance of y_t and it is constant across time, then:

$$V = E(y_t^2) = E[(\varphi y_{t-1} + \epsilon_t)^2] = \varphi^2 V + \sigma^2 + 2\varphi E(y_{t-1}\epsilon_t) \quad (3.23)$$

However, the last element of the sum is equal to 0 given $y_{t-1} = C(L)\epsilon_{t-1}$ and, therefore, $E(y_{t-1}\epsilon_t)$ is a linear combination of auto covariance of *white noise*. Accordingly,

$$V = \varphi^2 V + \sigma^2 \Rightarrow V = \frac{\sigma^2}{1 - \varphi^2} \quad (3.24)$$

This provides two main pieces of information. Firstly, it is possible to consider a process with variance constant across time only if $|\varphi| < 1$. Indeed, this condition excludes from the stationary AR(1) process those with $|\varphi| \geq 1$. Secondly, the non-conditional variance (V) of y_t is always greater than σ^2 and the difference between them is higher as φ is closer to 1. In other words, the higher the persistence over the process, the lower is the non-conditional variance and, therefore, the knowledge of value of y_{t-1} reduces the uncertainty on the value of y_t the longer is the persistence over the series. Accordingly, the autocovariance of AR(1) is formally written as follows:

$$\gamma_1 = E(y_t y_{t-1}) = E[(\varphi y_{t-1} + \epsilon_t) y_{t-1}] = \varphi V \quad (3.25)$$

therefore

$$\gamma_k = E(y_t y_{t-k}) = E[(\varphi y_{t-1} + \epsilon_t) y_{t-k}] = \varphi \gamma_{k-1} \quad (3.26)$$

and so

$$\gamma_k = \varphi^k \frac{\sigma^2}{1 - \varphi^2} \quad (3.27)$$

Autocorrelations represent an index of *memory* of process. Accordingly, the

higher their (absolute) values, the higher is the (absolute) value of φ , which is the persistence parameter. Given $\lim_{k \rightarrow \infty} \gamma_k = 0$, γ_k is always different from 0. The *memory* of process is infinite but the remote past does not play an important role. If we include the intercept to the AR(1) process, then the formula 3.17 is rewritten as follows:

$$y_t = \mu + \varphi y_{t-1} + \epsilon_t \rightarrow (1 - \varphi L)y_t = \mu + \epsilon_t \quad (3.28)$$

therefore

$$y_t = (1 + \varphi + \varphi^2 + \dots)\mu + C(L)\epsilon_t = \frac{\mu}{1 - \varphi} + C(L)\epsilon_t \quad (3.29)$$

and so $E(y_t) = \frac{\mu}{1 - \varphi}$. The generalization of AR(p) is derived from the inversion of the polynomial of the p-th grade of a moving average process, as follows:

$$C(L) = A(L)^{-1} = \prod_{j=1}^P (1 - \lambda_j L)^{-1} \quad (3.30)$$

where λ_j is the reciprocal root of $A(L)$. An AR(p) process is stationary only if $|\lambda_j| < 1$ for each j . The properties of the AR(p) process are:

- it has an infinite *memory* but the autocorrelations geometrically decrease as k increases;
- if the intercept is different from 0, its expected value is $\frac{\mu}{A(1)}$, where $A(1)$ is the

polynomial $A(z)$, with $z = 1^3$.

An extreme case of AR(1) is a *random walk* (I(1)) process where the characteristics of persistence are so strong as to affect the qualitative features of the process itself. Indeed, a process (y_t) follows a random walk, if Δy_t is a *white noise*. Therefore, if $y_t = y_{t-1} + \epsilon_t$ and replacing y_{t-1} to the past value, then

$$y_t = y_{t-n} + \sum_{i=0}^{n-1} \epsilon_{t-i} \quad (3.31)$$

The characteristics of this kind of process are that the variance is unlimited, the mean is not reverting (as in the stationary process), and memory is permanent. A *random walk with drift* is a nonstationary process, formally written as follows:

$$\Delta y_t = \mu + \epsilon_t \quad (3.32)$$

where y_t comprises a random walk on a linear function across time. If the *drift* (which is the constant μ) is positive, then the process tends to increase with stronger fluctuations surrounding this trend across time. Then, formula 3.32 is rewritten as follows:

$$y_t = \sum_{i=0}^t \epsilon_i + \mu \cdot t \quad (3.33)$$

where the second element is a linear trend with slope μ .

In 1999, Erikson and Wlezien proposed to employ the AR(1) process to estimate

³Specifically, $A(1) = \sum_{i=0}^p a_i$

the dynamics of time series polls. They assumed that the true voter sentiment of one day is explained as a function of voter sentiment on the previous day and shocks from the election campaign broadly speaking, formally written as follows:

$$P_t = \alpha + \gamma P_{t-1} + \mu_t \quad (3.34)$$

where α is the constant, P_t refers to the polls at time t , and μ refers to the new shocks for day t . Therefore, the variance of daily shocks (μ_t) and their persistence will comprise the real movement when it occurs. This model assesses the degree to which the sampled voting intention may vary over time as a function of the time lapse between readings. If the campaign follows a simple AR(1) stationary time series, the autoregressive parameter (γ) is less than 1 and the true correlation between poll readings over m days is γ^m . In addition, the correlation between poll readings decreases geometrically as the number of days between polls increases. Specifically, the more γ is close to 0, the more only recent events over the election campaign matter. Conversely, the closer γ is to 1, the more effects there are from the remote past. However, if the campaign effects quickly disappear and matter less on Election Day, then the values of γ decreases across the time series. If the parameter $\gamma > 1$, then the process follows an integrated series (also known as *random walk*), where the variance grows over time and the values of parameters are likely to go up and down. If voters sentiment change follows an integrated series, the current preferences are functions of campaign shocks both from the past and present and,

for this reason, the value of γ may go up and down across the time series. To assess the underestimation of true over-time correlation between polls due to sampling error, they employ the statistical theory of reliability proposed by Heise (1969). In other words, they estimate the true correlations from observed correlations and statistical reliability (*rel*) of poll readings as follows: the observed correlation is the true correlations γ multiplied by *rel* over 1 day; it is $\gamma^2 rel$ over 2 days, and so on. There is also statistical error added by random error.

As with the house effect model, we will run the AR(1) for each coalition in order to investigate whether voters sentiment change occurs for each coalition over time. Before proceeding with the analysis of pooled poll results, we will undertake an analysis of variance as explained above in order to identify the cases where it is possible to argue that voters sentiment change towards a given coalition.

3.5 Conclusion

What causes inaccuracy in Italian polling? To answer this question, two main hypotheses have been derived: the house effect and voters sentiment change. This chapter has been devoted to explaining the statistical models employed to verify the two hypotheses. The next three chapters will show the empirical evidence provided by these models. Moreover, this chapter showed the revision applied to each model employed in the literature so far in order to apply them to the Italian case with its many parties and coalitions. Accordingly, we firstly revised the well-established *A*

measure for the accuracy of polls' prediction by introducing the A' measure which allows us to quantify the over- or underestimate for a given political party. Secondly, we further applied the Erikson and Wlezien (1999) approach to estimate the house effect across election campaigns by regressing the poll readings for each party/coalition in the election race on the set of dummy variables for each day with at least one poll readings and the dummy polling house variables. In addition, we ran the model by using the accuracy indexes (A , A' , and B_w) as dependent variables in order to estimate the extent to which their variance is explained by the variance of days and polling houses. Thirdly, we revise the Panogopoulus (2009) model by using the accuracy indexes as dependent variables to estimate the extent of the house effect deriving from the methodologies employed by polling houses in Italian polling. Fourthly, we further applied the AR(1) model proposed by Erikson and Wlezien (1999) to each party/coalition in the election competition to investigate voters sentiment change across campaigns concerning the given party/coalition.

Chapter 4

2006 Italian General Election

4.1 Introduction

The 2006 Italian general election was characterized by the presence of two main coalitions and a very small number of unaligned parties. The election results were: 49.8% for Unione, 49.7% for Casa delle Libertà, and 0.5% for other parties. According to this, the results gave a narrow victory to the centre-left. As already pointed out, this election was also characterized by two important new factors. Firstly, the electoral system was once more proportional with a majority bonus for the party/coalition with the highest support. One of the effects of the bonus was to emphasize the tendency of the Italian system to be a multi-coalition rather than a multi-party system. Secondly, the centre-right coalition election campaign was focused among other things on a constant reference to poll readings. In the light of this, the role of polls during the Italian election campaign became more important than in any

previous election.

This chapter is devoted to providing evidence concerning the accuracy and the causes of inaccuracy in polls that were published during the 2006 Italian general election campaign and that asked respondent about their voting intentions for the Chamber of Deputies. According to this, we analyzed the polls published on the official website between 1 October and 24 March 2006¹.

With this in mind, the remainder of this chapter is structured as follows. The next section will be devoted to presenting an analysis of accuracy using both A , A' , and B_w measures and to discussing the evidence provided by their outcomes. In the third section, we will present the house effect analysis in order to estimate how much the variance of poll readings is affected by the methodologies employed by different polling houses. To do that, we will firstly apply a well-established econometric method (OLS) and the lowess procedure (Cleveland 1979) following the approach proposed by Erikson and Wlezien (1999). Then, we employ a multivariate regression model to estimate the extent of the house effect caused by the methodologies employed by polling houses using the accuracy indexes as dependent variables. In the fourth section, we will employ two different analyses in order to estimate the extent of change in voters sentiment for each coalition over the election campaign. Specifically, we will undertake a traditional analysis of variance, using measures like sampling error and reliability to estimate the error in the poll readings. Then, we will employ a more sophisticated analysis using an autoregressive model (AR(1)) in

¹That means 175 days before Election Day, which cover the entire electoral campaign. On the basis of Italian law, polls cannot be published during the 15 days before Election Day.

order to estimate whether the error is due to sampling procedures or voters sentiment change. Finally, in the fifth section we will draw the main conclusions on the basis of evidence provided by all the analysis undertaken.

4.2 Accuracy Results

Recalling the formula 3.1, to measure the accuracy of polls in the 2006 Italian national election, we apply the formula to the Unione and Casa delle Libertà treating each coalition as a party and a third coalition, composed of those small parties unaligned as third-party candidates (“Others”). So as well as applying the original formula to the two main coalitions, we adapt the measure to enable us to take account of this. Therefore, we rewrite equation 3.1 as follows:

$$A'_{cdl} = \ln \left[\frac{(cdl/(u + o))}{(CDL/(U + O))} \right] \quad (4.1)$$

where cdl is the Casa delle Libertà poll prediction, u is the Unione poll prediction, and o is the Others poll prediction. Conversely, CDL is the actual results obtained by the Casa dell Libertà, U is the actual results for the Unione, and O is the actual results achieved by the others. We do the same for the other two parties².

Recalling the Martin, Traugott, and Kennedy’s measure, if the value of A' is positive, the poll overestimates support for the party. Conversely, when the value is negative, the poll underestimates support. Finally, we need a measure of the extent

²Please refer to the Appendix for the full list of A' measures.

to which under- and over-estimates are significant as opposed to falling within the margins of what can be expected due to sampling error. We obtain this by calculating the standard error of A' and by using a 95% confidence interval. Therefore, polls given values of A' falling outside the confidence interval we regard as inaccurate, those given value within it as accurate. To simplify the calculation of variance, the odds ratio has to be transformed by taking its natural log. Recalling equation 4.1, we rewrite the equation 3.2 as follows:

$$Variance(A'_{cdl}) = 1/(n \cdot cdl \cdot (u + o)) \quad (4.2)$$

where n is the number of respondents and cdl , u , and o are Casa delle Libertà, Unione and Others respectively³.

We will also employ the original measure (equation 3.1) in order to compare the outcomes between the two formulas. Therefore, the Casa delle Libertà and Unione coalitions will be considered as parties:

$$A_{06} = \ln \left[\frac{(cdl/u)}{(CDL/U)} \right] \quad (4.3)$$

To estimate the overall error for each poll readings, we employ the measure B proposed by Arzheimer and Evans (2014) which takes into account all the parties/coalitions competing the election at the same time, and which corrects for the dependency of A' on the reference party (see formula 3.5). Given the presence of

³Please refer to the Appendix for the full list of measure for the variance of A' .

small unaligned parties in the Italian political system, we apply the weighted version of this measure: B_w .

Following the literature on election studies, we expect the 2006 polls to be more accurate closer to Election Day. To estimate this assumption, we will check the timing of accuracy/inaccuracy on the basis of evidence provided by the A , A' , and B_w measures. Specifically, we compare the monthly averages of three measures and the monthly percentages of the polls classified as inaccurate by A and A' and the monthly percentages of the polls that are statistically biased according to the χ^2 test using the threshold $p \leq 0.05$ for the B_w measures.

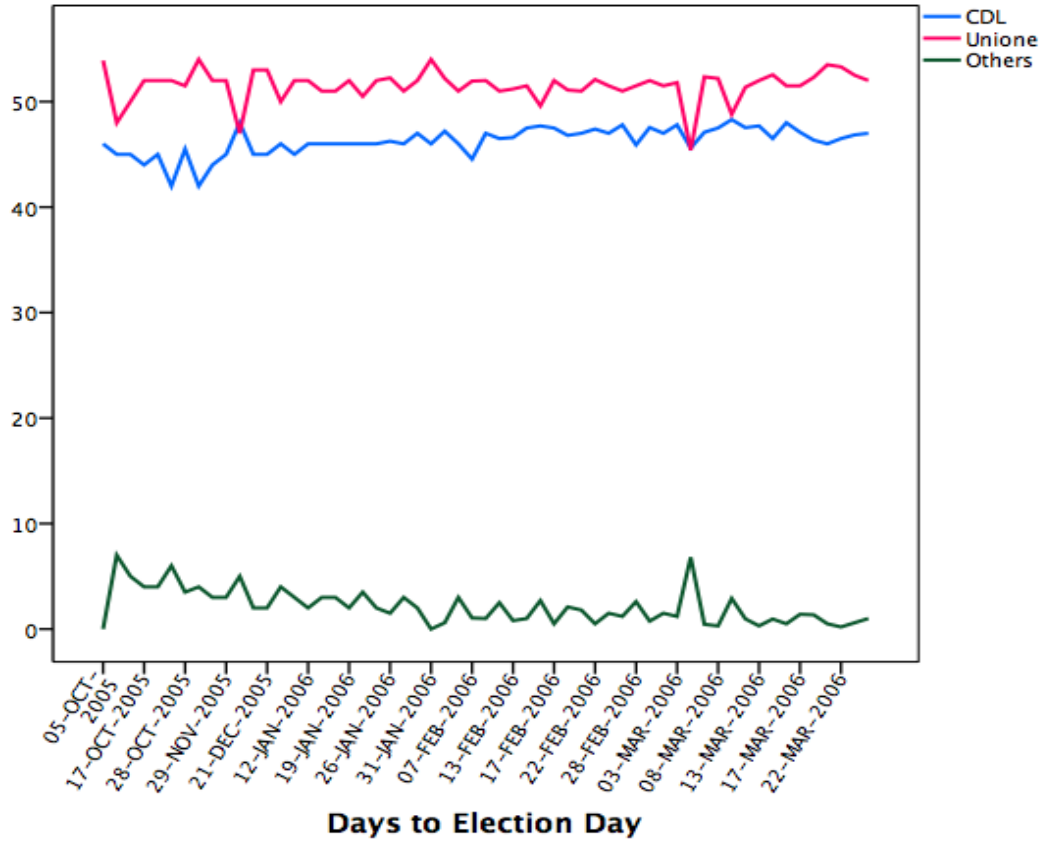
4.2.1 Findings

Were the Italian pollsters really wrong in 2006? To answer this question, we have undertaken an empirical analysis of the accuracy of the polls published during the six months prior to Election Day that asked about voting intentions. The analysis only covers polls concerning voting intentions for the Chamber of Deputies excluding those for the Senate. In addition, we also include in the analysis those polls where the pollster did not specify which of the two branches of Parliament was being referred to. On this basis, there were 75 polls for the Chamber of Deputies.

As figure 4.1 shows, the poll readings over the election campaign concerning the three coalitions present the same unstable trend. In other words, all the shares vary within a range of $\pm 10\%$. In particular, the poll readings for ‘Others’ present a persistent oscillating trend which decreases closer to Election Day reaching a peak

Figure 4.1: 2006 Italian General Election polls for the three coalitions over the six months of the election campaign.

y-axis = percentage support according to poll readings. x-axis = dates n which poll readings were taken.



at the beginning of the last month of the election campaign (10%). With this in mind, we have undertaken an accuracy analysis of these poll readings. Table 4.1 compares the percentages of polls classified as inaccurate when measures of A , A' , and B_w are applied. Recalling the main difference between the three measures, when A' is applied, it provides an estimate of the accuracy of poll predictions for each party rather than an estimate of overall accuracy of poll predictions provided by A measure. The B_w gives information on the degree of error estimated for each poll prediction taking into account all the parties/coalitions in the electoral race.

Focusing on the first column of the table, when A is applied only 32% of polls are

Table 4.1: 2006 Italian General Election polls on Chamber of Deputies: comparison of percentage of inaccuracy applying A , A' , and B_w measures.

The percentages for the A and A' measures refer to their values falling outside the 95% confidence interval. The A measure is computed considering only two coalitions (CDL and Unione) using the formula 4.3. The A' measures is computed using all the coalitions competing the election (formula 4.1, A.1, and A.2). The percentages for the B_w measure refer to the proportion that are statistically biased on the basis of χ^2 test using $p \leq 0.05$ threshold. The B_w measure is computed using the formula 3.5.

| | Polls | CDL | Unione | Others |
|-------|-------|-----|--------|--------|
| A | 32% | — | — | — |
| A' | — | 60% | 91% | 73% |
| B_w | 76% | — | — | — |
| N | 75 | 75 | 75 | 75 |

classified as inaccurate. Instead, the total percentage of polls statistically biased using the χ^2 test for the B_w measure rises to 76%. When A' is applied the percentages are 60, 91, and 73 for the Casa delle Libertá, the Unione, and Others respectively. These results are more in line with the percentage of polls statistically biased using the B_w rather than the A measure. Therefore, according to table 4.1 in the 2006 general election there is a high percentage of inaccuracy among polls concerning all coalitions. Looking in more depth at those percentages of poll inaccuracy, table 4.2 compares the monthly averages and percentages of polls accuracy predictions using A , A' , and B_w measures during the entire election campaign. The second column of table 4.2 reports the monthly averages and the percentages of polls that are statistically biased using the χ^2 test for the B_w measure. Accordingly, when A is applied there is a constant underestimation across time given its negative sign, except during the first month of the election campaign. In particular, the average

of A values in the last two months of the election is 0. Indeed, the percentage of polls classified as inaccurate using the A measure lessens closer to the Election Day. This is also confirmed by the B_w measure, where the percentage of polls that are statistically biased decreases from 100% in the first month of the campaign to 60% in the last one.

Table 4.2: 2006 Italian General Election polls on Chamber of Deputies: monthly average and percentage of inaccuracy of A , A' , and B_w measures.

The percentages for the A and A' measures refer to their values falling outside the 95% confidence interval. The A measure is computed considering only two coalitions (CDL and Unione) using the formula 4.3. The A' measure is computed using all the coalitions competing the election (formula 4.1, A.1, and A.2). The percentages for the B_w measure refer to the proportion that are statistically biased on the basis of the χ^2 test using $p \leq 0.05$ threshold. The B_w measure is computed using the formula 3.5.

* the values of A' for the given month are both positive and negative.

| | | Polls | | CDL | Unione | Others |
|-----------------|---------|--------|-------|--------|--------|--------|
| | | A | B_w | A' | A' | A' |
| October | average | 0.802 | 0.151 | -0.207 | 0.217 | 1.812 |
| | % | 63 | 100 | 100 | 88 | 100 |
| November | average | -0.189 | 0.192 | -0.242 | 0.329 | 1.918 |
| | % | 100 | 100 | 100 | 100 | 100 |
| December | average | -0.091 | 0.130 | -0.147 | 0.146 | 1.868 |
| | % | 50 | 100 | 75 | 75 | 100 |
| January | average | -0.116 | 0.120 | -0.150 | 0.207 | 1.298 |
| | % | 27 | 80 | 87 | 100 | 80 |
| February | average | -0.090 | 0.097 | -0.113 | 0.166 | 0.989* |
| | % | 6 | 77 | 33 | 89 | 78 |
| March | average | -0.092 | 0.101 | -0.107 | 0.174 | 0.472* |
| | % | 33 | 60 | 44 | 89 | 52 |

For the sake of simplicity, we will interpret the outcomes of the A' measures by

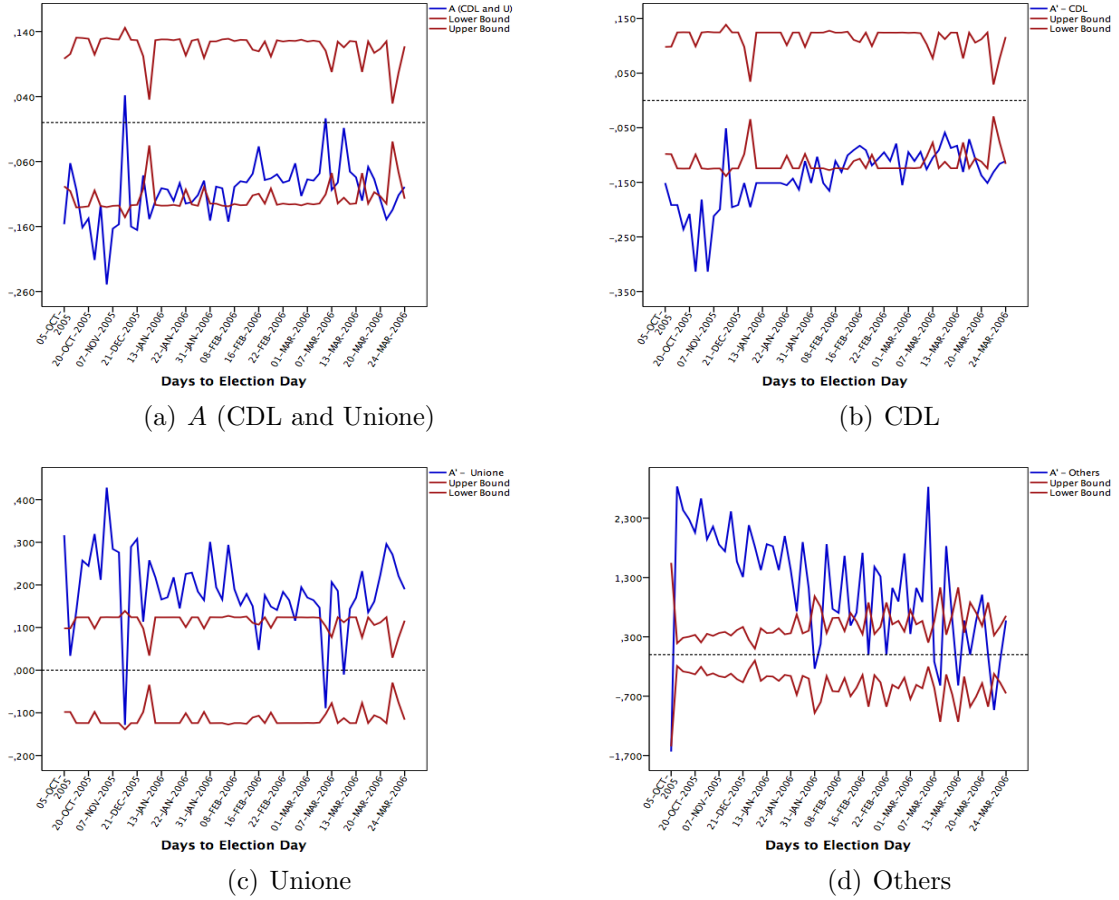
discussing each coalition separately. Regarding the Casa delle Libertá coalition, according to table 4.2 there was a constant underestimation across time. Despite this, the proportion of inaccurate polls decreases closer to Election Day. For instance, from January to February the proportion of polls that are inaccurate falls by more than half, dropping from 87% to 33%. Regarding the Unione coalition, table 4.2 shows a constant overestimation of polls with a significant positive average value of A' throughout the six months of the campaign. Focusing on the timing of inaccuracy, the percentage of inaccurate polls is high in each month even if there is a slight decrease over the last two months. This is consistent with the 91% polls classified as inaccurate (see table 4.1). Regarding the group of small parties not aligned with any coalitions ('Others'), table 4.2 shows that there was a constant overestimation of their support. As for the overall polls (A) and the Casa delle Libertá coalition, the percentage of polls that are inaccurate decreases over time. Specifically, from the 100% of the first three months, the inaccuracy rates decrease with an average decrease of 20% less for each of the last three months reaching 52% in March 2006.

To look in more depth at these trends, figure 4.2 shows the values of A and A' and their confidence interval for the Casa delle Libertá, the Unione, and Others. All the values outside the confidence intervals are classified as inaccurate and vice versa. According to figure 4.2(a), almost all of the inaccurate polls are in the first two months and the most accurate are in the last months of the election campaign, where some values reach or are very close to 0.

According to table 4.2 and figure 4.2(b), none of the values of A' for the Casa

Figure 4.2: Accuracy values applying A and A' measures and their confidence intervals

y-axis = the accuracy values using the formula 4.34.1, A.1, and A.2 for panel (a), (b), (c), and (d) respectively.
x-axis = dates on which poll readings were taken.



delle Libertà reach the line of 0 nor, above all, have a positive sign. Indeed, those values are almost always higher than - 0.100, which represents a good distance from 0 (that is the perfect agreement between poll predictions and election results).

As figure 4.2(c) shows, the values of A' for the accuracy of prediction of support of the Unione almost always fall outside the confidence interval. The most interesting information is that the only value inside the confidence interval belongs to the American polling house whose poll was commissioned by Berlusconi (leader of the

Casa delle Libertá coalition), who claimed that Italian pollsters were biased in favour of the centre-left over the entire election campaign. Moreover, those values are the only negative value of the sample and they have values closer to 0 as the number of days to Election Day decreases.

According to figure 4.2(d), over the six months before Election Day the values of A' for the group of small parties present an oscillating trend. As for the Unione and the overall poll readings, there are few cases that reach the line of 0 and, as already explained above, there is a constant decay in the last part of the election campaign. In fact, there is also the presence of negative values of A' . This is the reason why the average of values of A' for February and March are lower than in the previous months (see table 4.2).

According to these outcomes, all the accuracy measures employed revealed that a large proportion of polls conducted during the 2006 Italian general election were inaccurate and, except for the case of the Unione coalition, these percentages decrease over time.

4.3 House Effect Results

In the previous section, we showed that in the 2006 Italian general election there was a high percentage of polls classified as inaccurate for the two main coalitions (Casa delle Libertá and Unione) and for the group of small parties not aligned with coalitions ('Others'). Moreover, the B_w measure revealed the presence of a

significant degree of error bias among poll readings.

Therefore, what causes this high percentage of inaccuracy? In this thesis, two hypotheses have been derived concerning this: the house effect and the voters sentiment changes. In this section, we undertake a statistical analysis of the house effect, where the latter refers to biases caused by the methodologies employed by different polling institutions.

The model proposed by Erikson and Wlezien (1999) assumes that the variance of poll readings from one day to the next is caused by the house effect. To estimate it, they regress with no intercept the poll readings in a set on $N-1$ polling houses and k dummy variables for each day with at least one poll reading (see formula 3.6). The coefficient of day dummy variables expresses the house effect. In addition, they employ the lowess procedure proposed by Cleveland (1979) to estimate the presence of random error in the series. In order to estimate which methodology used by polling houses affects most the predictive accuracy of Italian polling, we employ a multivariate regression model where the A , A' , and B_w measures are the dependent variables (see formula 3.15).

4.3.1 Findings

As for the accuracy measures, the house effect model proposed by Erikson and Wlezien (1999) has been developed on the basis of the American system. Therefore, to adopt to the Italian case, we will apply the OLS method to each coalition. In other words, we will regress the poll readings for each coalition on a set of 13 dummy

variables for the polling houses ($N - 1$) and 57 dummy variables for each day with at least one poll reading. Then, we will apply the lowess procedure in order to estimate the amount of random error in the series. Applying this model to each coalition will allow us to estimate the house effect separately. In other words, it is possible that the methodologies employed by different polling houses may affect one coalition more than others.

Table 4.3 compares the outcomes of three models to investigate the house effect for the 2006 Italian general election. In addition, the first panel of the table refers to the model using the poll readings for each coalition plus the group of small unaligned parties ('Others') as the dependent variable. The last panel refers to the model using the values of A , A' , and B_w as dependent variables. The reason for using the accuracy values measures as dependent variables lies with the main purpose of investigating in depth the causes of inaccuracy. In other words, in the light of explaining why the Italian polls were so highly inaccurate in the 2006 general election, using the values of A , A' , and B_w as dependent variables rather than the poll readings allows us to examine in more depth how much of the variance of inaccuracy values is due to the house effect. Recalling the expectation, the variance of days and houses explains the variance of poll readings and accuracy values: that it is inaccurate.

Table 4.3: 2006 Italian General Election: House Effect analysis using OLS regression with no intercept and poll readings and poll's accuracy values as dependent variables

In the panel called 'poll readings', the dependent variable is the shares series for the given party/coalition. The OLS regression model refers to the formula 3.12. In the panel called 'Accuracy Values', the dependent variable is the accuracy values series for the given party/coalition. The first three columns of the panel refer to the A' measures using the formula 4.1, A.1, and A.2 respectively. The OLS regression model refers to the formula 3.13. The column called ' A ' refers to the accuracy values series computed using the formula 4.3 as dependent variable. The OLS regression model refers to the formula 3.14. The column called ' B_w ' refers to the error estimated series using the formula 3.5. The OLS regression model refer to the formula 3.14.
 (*) The statistical level of significance for the ANOVA test follows the rule: 1% = $p < 0.01$; 5% = $p < 0.05$; 10% = $p < 0.10$

| | poll readings | | | | Accuracy Values | | | |
|---------------------------------|---------------|--------|--------|--|-----------------|--------|--------|-------|
| | CDL | Unione | Others | | CDL | Unione | Others | B_w |
| Model 1: Days | | | | | | | | |
| R^2 | 0.98 | 0.98 | 0.96 | | 0.97 | 0.95 | 0.92 | 0.92 |
| Adjusted R^2 | 0.94 | 0.94 | 0.85 | | 0.91 | 0.82 | 0.69 | 0.70 |
| ANOVA* (sign.) | 0.000 | 0.000 | 0.000 | | 0.000 | 0.000 | 0.001 | 0.000 |
| Model 2: Houses | | | | | | | | |
| R^2 | 0.96 | 0.96 | 0.71 | | 0.90 | 0.86 | 0.67 | 0.89 |
| Adjusted R^2 | 0.95 | 0.96 | 0.65 | | 0.88 | 0.84 | 0.60 | 0.86 |
| ANOVA* (sign.) | 0.000 | 0.000 | 0.000 | | 0.000 | 0.000 | 0.000 | 0.004 |
| Model 3: Days and Houses | | | | | | | | |
| R^2 | 0.99 | 0.99 | 0.98 | | 0.99 | 0.98 | 0.97 | 0.99 |
| Adjusted R^2 | 0.98 | 0.97 | 0.89 | | 0.93 | 0.91 | 0.84 | 0.92 |
| ANOVA* (sign.) | 0.000 | 0.000 | 0.000 | | 0.000 | 0.000 | 0.001 | 0.000 |

Table 4.3 shows the outcomes of three models applied both to poll readings and accuracy values using different independent variables. For the sake of simplicity, the outcomes will be presented for each model. In the first model, we regress poll readings (accuracy values) on the dummy variables of days in which at least one poll reading was taken. According to table 4.3, all *Adjusted R²* are higher than 0.80, meaning the variance in poll readings and accuracy values depends in large part on the variance of days. Only for the accuracy values of ‘Others’ and the B_w measure, *Adjusted R²* lower than the rest (0.69 and 0.70 respectively). Therefore, we may argue that other factors affected their accuracy. In the second model, the poll readings (accuracy values) are regressed on the dummy variables of the polling houses. As for the previous model, table 4.3 provides evidence of high *Adjusted R²* values, which vary between 0.84 and 0.96. As for the first model, poll readings and accuracy values for the ‘Others’ report the lowest *Adjusted R²* and this occurs also when the B_w measure is employed as the dependent variable. In the third model, we fully apply the model proposed by Erikson and Wlezien (1999) regressing the poll readings (accuracy values) on the dummy variable days where one poll at least appeared and on the dummy variable for polling houses. According to table 4.3, in all regressions *Adjusted R²* varies between 0.84 and 0.98 except when the B_w measure is employed as the dependent variable. Indeed, the last column of table 4.3 shows that the degree of error estimated by the B_w measure is less affected by the variance of days and the polling houses than all the other measures. Moreover, all the regressions using the three models meet the highest level of significance

using the ANOVA test, and, therefore, it may be possible to draw substantial and reliable conclusions. According to these outcomes, the hypothesis that the predictive accuracy of polls in 2006 was highly affected by the house effect has been confirmed in all three models proposed.

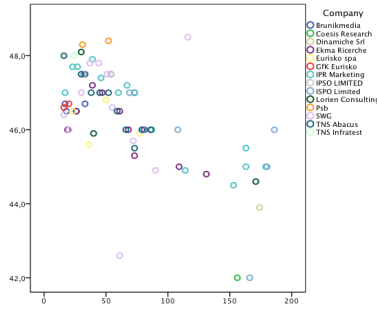
Despite the high variance explained by the house effect over the three coalitions, the previous analysis also shows that there was a certain amount of error, especially concerning the Others coalition. In order to estimate random error among the house-adjusted series for each coalition, we will employ the well established statistical procedure designed by Cleveland (1979), known as *lowess*. Recalling this procedure, it has the merit of creating a new value for each time point based on the outcomes of regression using a designed number of surrounding data points (Cleveland 1979, Beck and Jackman 1998). In other words, it is a procedure making it possible to fit better the line following the trend of regression results. The new values are generated using weighted predicted values based on their temporal distance from a specific point in question. The degree to which the line follows the data depends on the bandwidth used to generate the smoothed values. The lower the bandwidth, the more the fitted line represents the random error. We will apply the following bandwidths for each smoothed house-adjusted series: 0.40, 0.30, 0.20, and 0.10⁴. For the sake of simplicity, we report only the smoothed scatterplot using the bandwidth of 0.30 and 0.10 given that generate better fitted lines for the purpose of this thesis.

⁴We also applied the bandwidth 0.05, which is considered the most robust in order to estimate the random error, but the scatterplot obtained was illegible because the fitted line was outside the box figure. Please refer to the Appendix for the smoothed scatterplot with bandwidth 0.40 and 0.20.

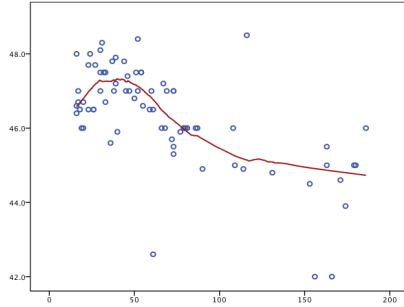
As for the other analysis presented in this chapter, the outcomes provided by scatter plot and the smoothed version of house-adjusted series will be discussed for each coalition separately. Therefore figure 4.3 shows the linear and the smoothed scatter plots using different bandwidths (0.30 and 0.10) with regard to the Casa delle Libertà coalition.

Figure 4.3: Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Casa Delle Libertà.

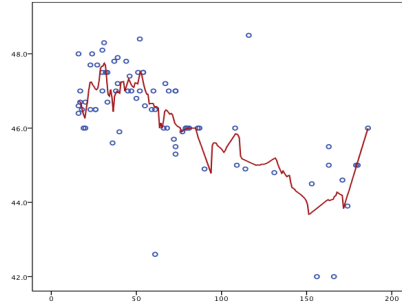
y-axis = house-adjusted polls the poll readings. x-axis = days remaining before Election Day.
The smoothed scatter plot is computed following model 3.7.



(a) Linear



(b) Smoothed: Bandwidth = 0.30



(c) Smoothed: Bandwidth = 0.10

Figure 4.3(a) shows, using a linear scatter plot, a negative correlation between the house-adjusted poll readings for the Casa delle Libertà coalition and the numbers of days between Election Day and the dates on which the poll readings were taken. In other words, figure 4.3(a) shows that as the number of days remaining before

Election Day decreases, the impact of the house effect on polls readings concerning this coalition increases.

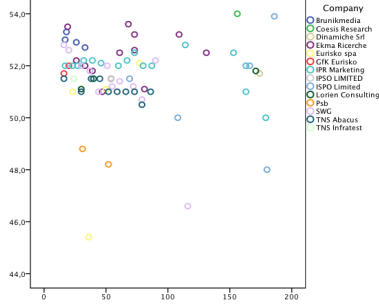
The bottom right panel (4.3(c)) shows that the fitted line using the smoothed procedure using the bandwidth of 0.10 is able to follow almost perfectly the series presenting low random error. The lowess procedure concerning the Casa della Libertà confirms the negative correlation between the house effect and the number of days provided by the previous analysis as well as the presence of random error. In other words, despite the robust evidence provided by the outcomes of these analyses, we cannot completely rule out that the inaccuracy of polls in predicting the Casa delle Libertà election results is also due to movement in voters sentiment and the degree of random error presented in the smoothed series comprises that movement.

Figure 4.4 shows the correlation between the house-adjusted poll readings and the number of days between the poll readings and Election Day for the Unione coalition using linear and smoothed scatter plots. According to this figure 4.4(a), there is a slightly negative relationship between the two variables. Specifically, all the values of poll readings for the Unione vary between 45% and 54%. As figure 4.4(a) shows, the greater the time gap between Election Day and the dates on which poll readings were taken, the higher is the dispersion among them.

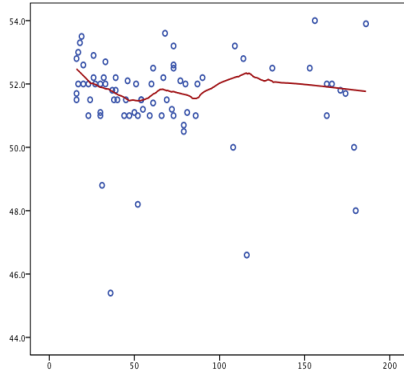
Using the lowess procedure, the series presents a similar pattern to that for the Casa delle Libertà. Specifically, the lower the bandwidth, the more the new values created by the smoothed version follow the house-adjusted series (4.4(c)). Because of this, we may argue that, despite the strong impact of the house effect,

Figure 4.4: Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Unione.

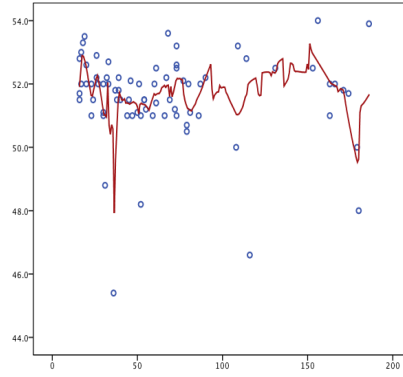
y-axis = house-adjusted polls the poll readings. x-axis = days remaining before Election Day.
The smoothed scatter plot is computed following model 3.7.



(a) Linear



(b) Smoothed: Bandwidth = 0.30



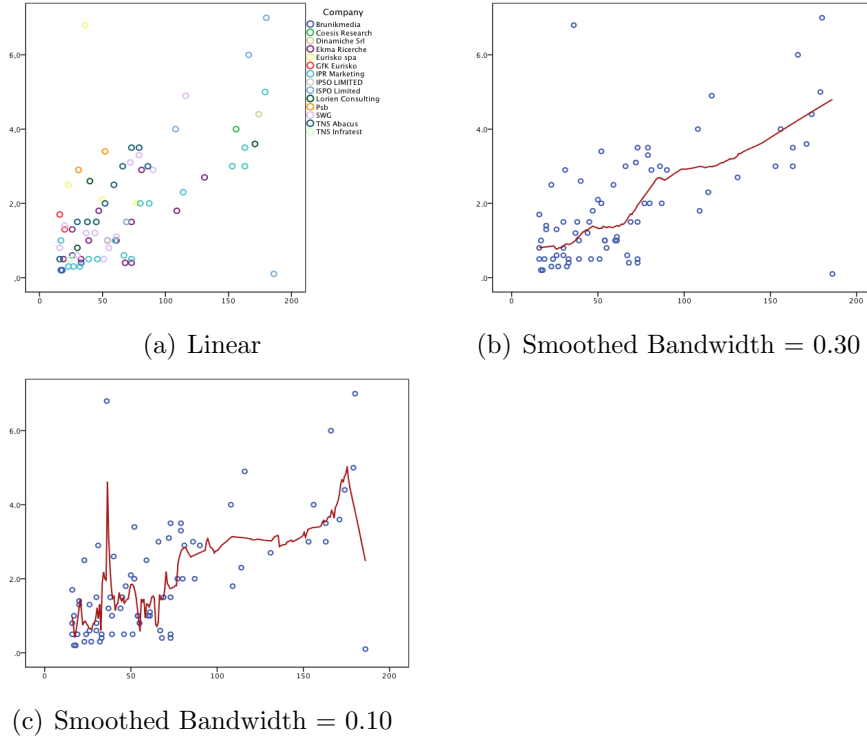
(c) Smoothed: Bandwidth = 0.10

the inaccuracy of poll readings in predicting the Unione election outcome presents more random effects than the Casa delle Libertà smoothed series, which may be due to voters sentiment change over the election campaign.

Figure 4.5 shows the positive relationship between the house-adjusted poll readings for the ‘Others’ coalition and the number of days between Election Day and poll readings using linear and smoothed scatter plots. Indeed, there is less dispersion close to Election Day and the poll readings vary between 1% and 2%. Instead, at the beginning of the election campaign, the gap widens to 6% of the share showing more

Figure 4.5: Linear and smoothed plots of house-adjusted polls aggregated by date: Others.

y-axis = house-adjusted polls the poll readings. x-axis = days remaining before Election Day. The smoothed scatter plot is computed following model 3.7.



dispersion. In other words, as the number of days before Election Day decreases so the impact of the house effect on polling accuracy in predicting the election outcome decreases.

As for the Casa delle Libertà and Unione coalitions, we apply the lowess procedure to Others in order to estimate the fitted line to regression outcomes. Figures 4.5(b) and 4.5(c) show the evidence of the smoothed versions of the house-adjusted series for Others. The bottom right panel shows the smoothed fitted line using the lower bandwidth 0.10 (4.5(c)). As for the previous analysis, the fitted lines of new values generated by the lowess procedure follow the original series closely showing the presence of significant number of random effect (more than in the other two

coalitions). Indeed, figure 4.5(b) shows that the smoothed series generated using the higher bandwidth is less sensitive and therefore, it follows to a lesser degree the trend of values of the original series. Moreover, these outcomes provide evidence of greater change in voters sentiment over the election campaign than in the Casa delle Libertà and Unione coalitions: it is shown in the random error present in the smoothed version of the series.

In the light of the positive relationship between house-adjusted poll readings and the number of days and the random error present in the smoothed series, we may argue that the inaccuracy of poll readings regarding the Others is also due to voters sentiment change more than in the other two coalitions.

All the evidence provided by the lowess procedure confirms the outcomes of the house effect regression analysis. Recalling table 4.3, in all three models applied *Adjusted R²* for the Others is the lowest and, in particular, running the model with only the house polling as independent variables. Specifically, this model estimates that only the 65% and 60% of variance of poll readings and accuracy values respectively are explained by the variance of house polling. This is consistent with the degree of random effect present in the smoothed versions of Others' series.

According to the aim of this thesis - to ascertain the factors that cause bias in Italian polling - we employ a multivariate regression model using the methodologies used by different polling houses as explanatory variables (see model 3.15). Table 4.4 reports the outcomes of this model applied to the 2006 Italian general elections, using the accuracy indexes as dependent variables.

Table 4.4: House effect across the 2006 Italian General Election polls on Chamber of Deputies: Multivariate Regression Model using A , A' and B_w measures as dependent variables.

The model is computed using formula 3.15, where a set of methodologies employed by polling houses and the difference between the two major party/coalitions (referred as DCEP) are the explanatory variables. The A , A' and B_w measures used as dependent variables are computed using the formula 4.3, 4.1, A.1, A.2, and 3.5. The standard errors for the coefficient are in parentheses and the statistical level of significance follows the rule: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

| | B_w | A | $A' - \text{CDL}$ | $A' - \text{Unione}$ | $A' - \text{Others}$ |
|--------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|-----------------------------|
| Random | -0.188* (0.101) | -0.001*** (0.001) | -0.017* (0.009) | -0.009 (0.006) | 0.440 (0.268) |
| Other Sample | 0.123 (0.347) | 0.001 (0.002) | 0.023 (0.032) | 0.014 (0.020) | -0.834 (0.920) |
| CATI | -0.177 (0.210) | 0.000 (0.001) | 0.001 (0.020) | 0.000 (0.013) | -0.317 (0.582) |
| CAWI | -0.172 (0.350) | 0.003 (0.002) | 0.055* (0.032) | 0.035* (0.020) | -2.392*** (0.925) |
| B: Media | 1.039** (0.422) | -0.002 (0.002) | -0.027 (0.039) | -0.015 (0.025) | 1.391 (1.117) |
| B: Polling House | 1.102** (0.441) | -0.003 (0.002) | -0.035 (0.040) | -0.021 (0.026) | 1.382 (1.167) |
| B: Political Party | 0.711* (0.416) | -0.003 (0.002) | -0.012 (0.038) | -0.006 (0.024) | 1.079 (1.102) |
| M: TV | -0.603** (0.294) | 0.000 (0.002) | 0.000 (0.027) | 0.000 (0.017) | -0.1078 (0.779) |
| M: Newspaper | -0.546** (0.271) | 0.001 (0.001) | 0.013 (0.025) | 0.007 (0.016) | -0.696 (0.718) |
| M: Internet | 0.733** (0.323) | 0.000 (0.002) | -0.008 (0.030) | -0.006 (0.019) | 0.086 (0.856) |
| DCEP | 0.052** (0.021) | 0.021*** (0.000) | 0.019*** (0.002) | -0.040*** (0.001) | 0.004 (0.056) |
| Constant | 0.465 (0.280) | 0.007*** (0.002) | -0.015 (0.026) | -0.012 (0.016) | 0.472 (0.742) |
| R^2 | 0.253 | 0.999 | 0.679 | 0.958 | 0.273 |
| Adjusted R^2 | 0.122 | 0.998 | 0.623 | 0.951 | 0.146 |
| ANOVA | 0.051 | 0.000 | 0.000 | 0.000 | 0.029 |

Recalling the model, we regress the accuracy index on a set of dummy variables for each methodology employed as documented by the polling houses and an exogenous variable (the difference between the two main parties/coalitions as reported by poll readings) to estimate the house effect. Specifically, we take into account the sampling procedure (random and no-random), the delivery method (CATI and CAWI), who commissioned the poll (media, polling house, and political parties) and where its results have been disseminated (TV, newspapers, and the Internet). For each dummy variables we expect a different relationship with the accuracy index. Accordingly, the main expectations are a positive relationship between the accuracy index and the following variables: no-random samples, CATI, CAWI, media and political parties as buyers, and the difference between the two main parties/coalitions estimated in the poll readings (hereafter referred as DCEP). For instance, the use of samples other than random ones increases the inaccuracy (error) of poll readings⁵. For the rest, we expect a negative relationship and, therefore, these variables increase (decrease) the accuracy (error) in Italian polling. For the sake of simplicity, the results will be discussed for each accuracy measure separately. We start by considering the model where B_w is the dependent variable. According to table 4.4, the majority of the explanatory variables included in the model meet the statistical level of significance. Focusing on these variables, almost all of them fulfill the expectations concerning the relationship with the B_w measure. Specifically, the use of random sampling procedures and the dissemination of their results in TV shows and

⁵Please refer to section 3.3.1 of chapter 3 for further explanation.

in newspaper articles decreases the overall error estimated by the accuracy index. Conversely, the higher the difference estimated by the polls between the two main coalitions across the campaign, the higher the overall error in Italian polling in the 2006 general elections. There is also a statistically significant positive relationship between the B_w measure and the dummy variables employed as buyer. This fulfills our expectations only in part given that we assumed that when a poll is carried on an institution's own initiative there is a negative impact on the degree of error estimated by the B_w measure.

Regarding the model where the A measure is the dependent variable, table 4.4 reports that only random sampling and the DCEP meet the statistical level of significance ($p < 0.01$). Moreover, the sign of their coefficient fulfills our expectations given that random sampling has a negative relationship with the A measure whereas the DCEP has a positive one. All the other variables in the model did not meet the statistical level of significance and, therefore, we cannot draw any substantial conclusions.

Focusing on the last three columns of table 4.4, the accuracy index concerning the Casa delle Libertà coalition has a negative relationship with the random sampling procedure as expected. Conversely, the use of CAWI as the delivery system for the interview and the DCEP have a positive relationship fulfilling our expectations. The rest of the variables did not meet the statistical level of significance. Concerning the the accuracy index for the Unione coalition, almost all the variables taken into account do not meet the statistical level of significance except the cases of the

CAWI and the DCEP. According to table 4.4, only the delivery method fulfills our expectations given the DCEP surprisingly shows a negative relationship with the accuracy index concerning the Unione coalitions. Considering the model using the accuracy index concerning the Other coalition, the CAWI delivery system is the only explanatory variable employed that meets the statistical level of significance fulfilling the main expectation of a positive relationship. In other words, by using this delivery method the inaccuracy of polls prediction for the small parties unaligned with any coalition increases.

4.4 Voter Sentiment Results

Although the previous section confirmed one of two hypotheses on which this thesis has drawn, it is not possible to rule out completely that voters sentiment change (even if small) over the election campaign cause inaccuracy in Italian polling. In order to estimate it, we will undertake a statistical analysis using two approaches. Firstly, we will estimate error in our sample span in both the last six and in the last two months of the election campaign to see what evidence it provides concerning the true voters sentiment change and, therefore, the reliability of the polls. Secondly, we will employ the autoregressive model to investigate the extent of the true over time voters sentiment change during the course of the 2006 general election using the well-established model proposed by Erikson and Wlezien (1999). As already pointed out many times, the nature of Italian system is a multiparty and multi-

coalition one and the procedures in the literature have been designed on the basis of the American system, which is a two party one. In order to estimate the true over time voters sentiment change, we will employ the autoregressive model using the poll readings for each coalition as the dependent variable. In doing so, we will be able to estimate the change for each coalition and the degree of these movements.

4.4.1 Analysis of Variance

The accuracy of poll predictions may consist of different measures on the basis of their various purposes. In this thesis, specific measures (A , A' , and B_w) have already been applied to estimate the difference between the poll readings and the election outcomes. The evidence provided so far shows the presence of a high degree of inaccuracy in Italian polling during the 2006 general elections in all the measures employed. Following the main purpose of this thesis - to estimate the major and, in particular, the strongest cause of inaccuracy - we undertake analysis of variance of the poll readings in order to identify their amount of error and the voters sentiment change. To do that, we employed the following measures: observed variance, error variance (and sampling error), true variance, and reliability. According to the evidence provided by house effect analysis, the expectation is that the presence of voters sentiment change for the three coalitions - and, in particular, for the group of Others - is composed of the true variance and reliability measures. In other words, when the amount of true variance is higher than the error measures.

Table 4.5 shows the outcomes of those measures covering the entire six months

Table 4.5: 2006 Italian General Election polls on Chamber of Deputies: analysis of variance all sample (October - March).

The analysis of variance is applied to all the competing parties/coalitions over the six months of the campaign. The Observed Variance (OV) refers to the variance of poll readings. The Error Variance (EV) is the average of error. The Sampling Error (SE) refers to formula 3.16. The True Variance (TV) is the difference between OV and EV. The Reliability is the ratio between TV and OV.

| | CDL | Unione | Others | Sample |
|-------------------|-------|--------|--------|--------|
| Mean | 46.35 | 51.49 | 1.95 | 2172 |
| Observed Variance | 1.77 | 2.05 | 2.47 | — |
| Error Variance | 1.14 | 1.15 | 0.09 | — |
| Sampling Error | 1.07 | 1.07 | 0.30 | — |
| True Variance | 0.62 | 0.90 | 2.38 | — |
| Reliability | 0.35 | 0.44 | 0.96 | — |

for each coalition plus the group of small parties not aligned with any coalition (‘Others’). For the sake of simplicity, the outcomes are discussed for each coalition separately. According to table 4.5, the poll readings concerning the Casa delle Libertá have 1.77 as observed variance and error variance of 1.14 (and its square root - sampling error - is 1.07). Subtracting the latter from the former, we obtained that true variance for the Casa delle Libertá is 0.62. In other words, the variance of polls reading, which is not due to sampling procedures by polling houses, comprises a small shift of voters sentiment over the election campaign. Moreover, this is confirmed by the estimation of statistical reliability (the ratio of true variance and observed variance), which is only 0.35. In other words, the evidence provided by these outcomes suggests that the poll readings for the Casa delle Libertá are affected more by sampling procedure than voters sentiment change during the 2006 Italian

election campaign. This has also been confirmed by the multivariate regression model in the previous section (see table 4.4). In order to estimate whether the inaccuracy in the last months of the election campaign is also due to voters sentiment change despite the evidence provided by house effect analysis, we will carry out the same analysis considering only the months of February and March.

Table 4.6: 2006 Italian General Election polls on Chamber of Deputies: analysis of variance two months (February and March).

The analysis of variance is applied to all the competing parties/coalitions over the last two months of the campaign. The Observed Variance (OV) refers to the variance of poll readings. The Error Variance (EV) is the average of error. The Sampling Error (SE) refers to formula 3.16. The True Variance (TV) is the difference between OV and EV. The Reliability is the ratio between TV and OV.

| | CDL | Unione | Others | Sample |
|-------------------|-------|--------|--------|--------|
| Mean | 46.95 | 51.56 | 1.30 | 2609 |
| Observed Variance | 0.90 | 1.78 | 1.36 | — |
| Variance Error | 0.95 | 0.96 | 0.04 | — |
| Sampling Error | 0.98 | 0.98 | 0.22 | — |
| True Variance | -0.05 | 0.83 | 1.31 | — |
| Reliability | -0.06 | 0.46 | 0.96 | — |

According to table 4.6, it would be not possible to argue that there was any voters movement during those months because the true variance and reliability outcomes are negative. In other words, the error variance and the sampling error are higher than the observed variance. Therefore, all the inaccuracy in polls in the last period of the election campaign is caused by the house effect, as already confirmed in the previous analyses.

Regarding the Unione, table 4.5 shows that the observed variance (2.05) of poll

readings for this coalition is higher than that for the Casa delle Libertà (1.77). What is interesting in the outcomes provided by this table is that the poll readings for the Unione have almost the same amount of error variance (1.15) as those for the Casa delle Libertà (1.14). In other words, these polls are affected by the same degree of error due to the sampling procedure employed by the polling house. This is only in part confirmed by the multivariate regression model where the use of a random sample has a statistically significant negative relationship with the accuracy values concerning the Casa delle Libertà (see table 4.4). However, true variance and reliability are higher because of observed variance: 0.90 and 0.44 respectively. Nevertheless, those measures comprise a low level of voters sentiment change throughout the entire election campaign. This is also consistent with the evidence provided by table 4.6, where the true variance and reliability of Unione did not change in the last two months. Therefore, we may argue that there is weak evidence of voters sentiment change over the election campaign both in the long and short term with regard to the Unione coalition.

Instead, the evidence in table 4.5 regarding the group of small parties not aligned with any coalition ('Others') estimates a higher level of voters sentiment change. In other words, the true variance and the reliability are 2.38 and 0.96 respectively. Those values are due to a very low error variance (0.09) and high observed variance (2.47) in the poll readings over the entire election campaigns. In other words, the inaccuracy of polls in predicting the election outcomes for the Others coalition are due to voters sentiment change rather than the sampling procedure employed by the

polling house. Moreover, table 4.6 also provides the evidence that this also occurred during the last two months of the election campaign with a lesser magnitude. Indeed, there is less observed variance (1.36), and error variance is only 0.04. These outcomes are consistent with the evidence provided by all the models employed for the house effect analysis.

4.4.2 AR(1) Results

The previous analysis of variance in poll readings for each coalition provided the evidence of a slight shift in voters sentiment over the election campaign in particular in the case of the Casa delle Libertá and the Unione. In order properly to estimate the degree of these movements, we will apply the autoregressive model (AR(1)) following the approach proposed by Erikson and Wlezien (1999, 2012). Recalling the model, it assumes that the true voters sentiment on one day is to be explained as a function of voters sentiment on previous days and shocks from the election campaign (see formula 3.34). Specifically, the variance of daily shocks and their persistence will comprise the real movement when it occurs. Assuming that the poll readings are a stationary series, the autoregressive parameter value will be between 0 and 1 and it will geometrically decay as the number of days between poll readings increases.

As for the previous analysis, we will discuss the outcomes of the AR(1) model for each coalition separately. Table 4.7 presents the outcomes of AR(1) applied to Casa delle Libertá poll readings. The first column reports the observed correlations

between the poll readings and their lagged values over 1 to 7 days.

Table 4.7: 2006 Italian General Election: true voters sentiment change using AR(1) for the Casa Delle Libertá.

In the column called ‘Correlation’, the values refer to the coefficient using the AR(1) - formula 3.34 -with different lag of days. In the column called ‘True Correlation’, Heise’s procedure (1969) is applied by multiplying the observed correlation to reliability (last row of table 4.5). The statistical level of significance follows the rules: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

| | Correlation (γ) | True Correlation ($\gamma * rel$) | R^2 | RMSE |
|-------|--------------------------|-------------------------------------|-------|------|
| Lag 1 | 0.317* | 0.111 | 0.24 | 1.18 |
| Lag 2 | 0.344** | 0.120 | 0.29 | 1.15 |
| Lag 3 | 0.560*** | 0.196 | 0.23 | 1.12 |
| Lag 4 | 0.399*** | 0.140 | 0.32 | 1.46 |
| Lag 5 | 0.490*** | 0.172 | 0.21 | 1.24 |
| Lag 6 | 0.432*** | 0.151 | 0.21 | 1.25 |
| Lag 7 | 0.421*** | 0.147 | 0.20 | 1.27 |

The main expectation is to observe a geometrical decay of values of parameter (γ), which comprise the movement in voters sentiment, as the number of days between poll readings increases. Instead, the evidence provided by the table shows the following pattern: 0.317, 0.344, 0.560, 0.399, 0.490, 0.432, and 0.421. Although it is not a stable increasing trend, those outcomes are not consistent with the expectation. In other words, for the Casa delle Libertá poll readings the values of the parameter increases as the number of days between polls increases. Specifically, using the first three lags over 1, 2, and 3 days respectively, the values of the parameter follow an increasing pattern and then, there is a slightly drop (0.399) with 4 days lagged values increasing again using 5 days as lag. Then, the values of the

parameter decay as between poll readings increasing to 6 and 7 days.

Now, we take into account the reliability of the polls to estimate the degree of movement in voters sentiment change - true over-time correlation - excluding the amount of error that would result from random sampling. To do that, we simply multiply the values of parameter reliability for the six months of the election campaign (0.35). The second column of table 4.7 presents the outcomes of true over-time correlations but the pattern of values of the parameter does not change so much. Specifically, the true over time correlation increases as the number of days between poll readings increases. Those outcomes are in line with the evidence provided by either the previous analyses (house effect and variance). In other words, there is not a clear and large voters sentiment change concerning the Casa delle Libertá. The slight movement observed in the AR(1) and Heise (1969) procedure is present over the longer lags between poll readings. On this basis, it is possible to argue that any movement occurs as a persistent-term effect from the election campaign and not as short-term effect.

Table 4.8 shows the results of AR(1) and Heise (1969) procedures for poll readings concerning the Unione. In contrast to the Casa delle Libertá, all the values of the parameter are negative and none of them meets the statistical level of significance. Therefore, it is not possible to draw any statistically significant conclusions from those outcomes. Nevertheless, the values of the parameter increase as the number of days between poll readings increases. In addition, none of those values satisfy the condition of stationary series that the parameter must be between 0 and 1.

Table 4.8: 2006 Italian General Election: true voters sentiment change using AR(1) for the Unione.

In the column called ‘Correlation’, the values refer to the coefficient using the AR(1) - formula 3.34 -with different lag of days. In the column called ‘True Correlation’, Heise’s procedure (1969) is applied by multiplying the observed correlation to reliability (last row of table 4.5). The statistical level of significance follows the rules: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

| | Correlation (γ) | True Correlation ($\gamma * rel$) | R^2 | RMSE |
|-------|--|---|-------|-------------|
| Lag 1 | -0.029 | -0.013 | 0.001 | 1.47 |
| Lag 2 | -0.043 | -0.019 | 0.002 | 1.48 |
| Lag 3 | -0.068 | -0.030 | 0.005 | 1.47 |
| Lag 4 | -0.076 | -0.033 | 0.006 | 1.46 |
| Lag 5 | -0.080 | -0.035 | 0.010 | 1.47 |
| Lag 6 | -0.078 | -0.034 | 0.006 | 1.48 |
| Lag 7 | -0.068 | -0.030 | 0.038 | 1.48 |

The pattern of values of the parameter does not change when taking into account the reliability of poll readings for the six months of the election campaign (0.44). The second column of table 4.8 shows that the values of the parameter multiplied by the reliability increase as the number of days between poll readings increases, reaching their peak using the lag of 5 days, and then, slightly decreasing using the lag of 6 and 7 days. Therefore, there is a small movement among voters concerning the Unione.

According to this evidence, it is possible to argue that the inaccuracy of poll readings is certainly due to the house effect rather than a significant voters sentiment change throughout the election campaign.

Table 4.9 shows the outcome of AR(1) and Heise (1969) procedures applied to

Table 4.9: 2006 Italian General Election: true voters sentiment change using AR(1) for the Others.

In the column called ‘Correlation’, the values refer to the coefficient using the AR(1) - formula 3.34 - with different lag of days. In the column called ‘True Correlation’, Heise’s procedure (1969) is applied by multiplying the observed correlation to reliability (last row of table 4.5). The statistical level of significance follows the rules: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

| | Correlation (γ) | True Correlation ($\gamma * rel$) | R^2 | RMSE |
|-------|--------------------------|-------------------------------------|-------|------|
| Lag 1 | 0.249** | 0.239 | 0.131 | 1.50 |
| Lag 2 | 0.175 | 0.168 | 0.130 | 1.50 |
| Lag 3 | 0.134 | 0.129 | 0.158 | 1.47 |
| Lag 4 | 0.216 | 0.207 | 0.128 | 1.50 |
| Lag 5 | 0.289** | 0.277 | 0.096 | 1.54 |
| Lag 6 | 0.020 | 0.019 | 0.137 | 1.51 |
| Lag 7 | 0.333** | 0.320 | 0.094 | 1.56 |

poll readings concerning the group of small parties not aligned with any coalition (Others). According to the first column, the values of the parameter are unstable given there is an oscillating pattern. In addition, only three out of seven values meet the statistical level of significance. Taking into account the reliability of those poll readings for the six months of the election campaign, the values of the parameter follow the same pattern (second column of table 4.9). Therefore, we may argue that even for the Others the degree of movement of voters sentiment was not as strong as expected. Indeed, this evidence is surprising because the main expectation concerning them was to estimate a stronger voters sentiment change according to the evidence provided both by the house effect and the variance analysis.

In the light of this evidence, it is possible to argue that there is a slight voters

sentiment change in the Others poll readings. However, their inaccuracy seems to be more due to the house effect than to change in voters sentiment.

4.5 Conclusion

Were the Italian pollsters really wrong in 2006? In the light of what has emerged from the analysis presented in this chapter, the answer to the question is: yes, they were wrong. Specifically, we estimated a high presence of inaccuracy using the A , A' , and B_w measures. Then, the OLS regression for each coalition and their accuracy values confirmed that the poll readings for the Casa delle Libertá, the Unione, and the Others has been strongly influenced by the house effect. In addition, the lowess procedure showed that although there is a degree of random error among the series, it is so small as to be consistent with the evidence provided by the house effect model. Using the multivariate model to estimate the impact of each methodology employed by the polling house on the predictive accuracy of poll readings, we can draw at least three main conclusions. Firstly, the difference estimated between the two main coalitions by poll readings has a positive relationship with all the accuracy measures employed. In other words, the higher its value, the higher is the inaccuracy estimated. Secondly, the delivery method plays an important role in the predictive accuracy of polls using the A' measure. Indeed, it is the only variable that always meets the statistical level of significance without regard to the coalitions. However, it increases the predictive accuracy of polls regarding the small parties not aligned

with any coalitions (Others). Thirdly, random sampling increases the predictive accuracy of polls especially when it is estimated using the overall indexes (A and B_w) as dependent variables.

To estimate whether the inaccuracy of polls is also due to voters sentiment change, in the previous section we presented the outcomes provided by two different analyses: variance and autoregressive models. Despite the presence of true variance in the series over the entire election campaign, the autoregressive model provides evidence that voters sentiment movement was so small that it did not affect the poll readings especially in the short term. With this in mind, rather than the polls, which itself as a method does not have the capacity to predict future voting intentions because of voters sentiment change, the inaccuracy of polls in the 2006 Italian general election was due to the so called house effect.

Chapter 5

2008 Italian General Election

5.1 Introduction

The 2008 Italian general election was characterized by the presence of three main coalitions, the centre party (UDC) running on its own and a group of unaligned parties (Others). The actual results of the elections were: 37.6% for the Partito Democratico, 3.1% for the Sinistra Arcobaleno, 46.8% for the Popolo della Libertà, 5.5% for the UDC, and 6.9% for other parties. The election results gave a victory to the centre-right coalition.

This chapter is devoted to providing evidence concerning the accuracy and the causes of inaccuracy of all polls published during the 2008 Italian general election campaign that asked about voting intentions for the Chamber of Deputies.

According to this, we analyzed the polls published on the official website be-

tween 1 October and 28 March 2008¹. With this in mind, the remainder of this chapter is structured as follows. The next section will be devoted to presenting the analysis of accuracy using the A , A' and B_w measures and a discussion of evidence provided by their outcomes. In the third section, we will present the house effect analysis in order to estimate how much the variance of poll readings is affected by the methodologies employed by different polling houses. To do that, we will firstly apply well-established econometric methods (OLS) and the lowess procedure (Cleveland 1979) following the approach proposed by Erikson and Wlezien (1999). Then, we employ a multivariate regression model to estimate the extent of the house effect caused by the methodologies employed by polling houses using the accuracy indexes as dependent variables. In the fourth section, we will employ two different analyses in order to estimate the extent of voters sentiment change for each coalition over the election campaign. Specifically, we will undertake a traditional analysis of variance, using measures like the sampling error and reliability, to estimate the error in the poll readings. Then, we will employ a more sophisticated analysis using an autoregressive model (AR(1)) in order to estimate whether the error is due to sampling procedures or voters sentiment change. Finally, in section five, we will draw the main conclusions on the basis of the evidence provided by all the analysis undertaken.

¹That means 179 days before Election day, which covers the election campaign. On the basis of Italian law, polls cannot be published during the 15 days before Election day.

5.2 Accuracy Results

Before discussing the evidence provided by the accuracy analysis, it is useful to recall its formula and its revision in order to fit the Italian case. Recalling the formula 3.1, to measure the accuracy of polls in the 2008 Italian national election, we applied the formula to the Partito Democratico (PD), Popolo della Libertà (PDL), treating each coalition as a party and the three small parties/coalitions, composed of the Sinistra Arcobaleno (SA), the Unione dei Democratici Cristiani e di Centro (UDC) and those small parties unaligned (“Others”) respectively, as third-, fourth- and fifth-party candidates. So as well as applying the original formula to the two main coalitions, we adapted the measure to enable us to take account of these. Therefore, we rewrite equation 3.1 as follows:

$$A'_{pdl} = \ln \left[\frac{(pdl/(pd + sa + udc + o))}{(PDL/(PD + SA + UDC + O))} \right] \quad (5.1)$$

where pdl is the Popolo della Libertà poll prediction, pd is the Partito Democratico poll prediction, sa is the Sinistra Arcobaleno poll prediction, udc is the Unione dei Democratici Cristiani e di Centro (UDC) and o is the Others poll prediction. Conversely, PDL is the actual result obtained by the Popolo della Libertà, PD is the actual results for the Partito Democratico, SA is the actual results for Sinistra Arcobaleno, UDC is the actual results for Unione dei Democratici Cristiani e di Centro (UDC), and O is the actual results achieved by the others. We did the

same for the other four parties².

As for the 2006 election, if the value of A' is positive, the poll overestimates support for the party. Conversely, if the value is negative, the poll underestimates support. To measure the extent to which under- and overestimates are significant as opposed to falling within the margins of what can be expected due to sampling error, we obtain it by the calculating standard error of A' and using a 95% confidence interval. Therefore, polls given values of A' falling outside the confidence we regard as inaccurate, those giving value within it as accurate. Recalling equation 5.1, we rewrite equation 3.2 as follows:

$$Variance(A'_{pdl}) = 1/(n \cdot pdl \cdot (pd + sa + udc + o)) \quad (5.2)$$

where n is the number of respondents and pdl , pd , sa , udc , and o are Popolo delle Libertá, Partito Democratico, Sinistra Arcobaleno, Unione di Centro, and Others polls respectively³. To compare the results with the other two elections, we apply the formula 3.1 to the Partito Democratico (plus Sinistra Arcobaleno), the Popolo delle Libertá (plus UDC), treating each coalition as a party and those small parties unaligned (“Others”) respectively, as third-party candidates⁴:

$$A'_{coal;pdl} = \ln \left[\frac{(pdl/(pd + o))}{(PDL/(PD + O))} \right] \quad (5.3)$$

²Please refer to the Appendix for the full list of A' measures.

³Please refer to the Appendix for a full list of the variance of A' measures.

⁴Please refer to the Appendix for the full list of A' measures.

In addition, we will employ the original formula in order to compare the outcome with the other two general elections. Following Martin, Traugott, and Kennedy's measure, Popolo della Libertà and Partito Democratico coalitions will be treated as parties⁵.

To estimate the overall error for each poll readings, we employ the measure (B) proposed by Arzheimer and Evans (2014) that takes into account all the parties/coalitions competing in the elections at the same time and which corrects for the dependency of A' on the reference party (see formula 3.5). Given the presence of small unaligned parties in the Italian political system, we apply the weighted version of this measure: B_w .

Following the literature on election studies, we expect that the 2008 polls will have been accurate closer to Election Day. To test this assumption, we will check the timing of accuracy/inaccuracy on the basis of the evidence provided by the A , A' , and B_w measures. Specifically, we compare the monthly averages of all measures and the monthly percentages of the polls classified as inaccurate by A and A' and the monthly percentages of polls statistically biased by the χ^2 for the B_w measures using the threshold of $p \leq 0.05$.

5.2.1 Findings

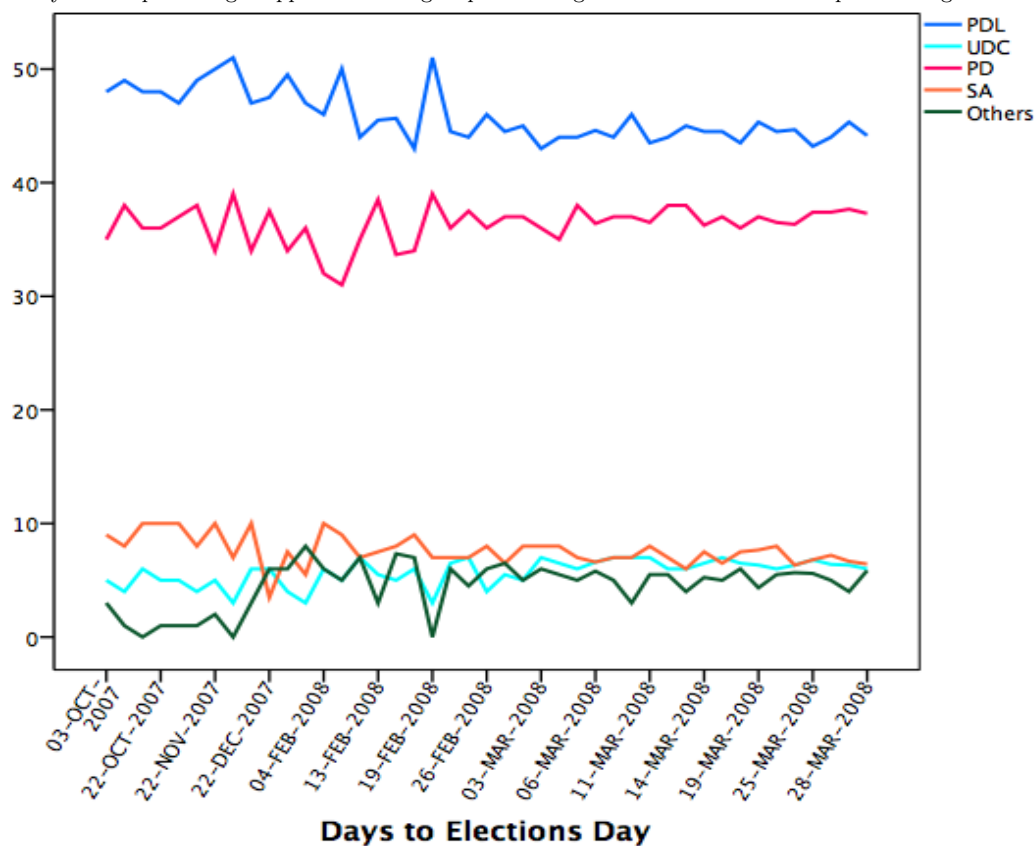
Were Italian pollsters more accurate in 2008 than in the previous election? To answer this question, we have undertaken an empirical analysis of the accuracy of

⁵Please refer to the Appendix for the measure.

the polls published during the six months prior to Election Day that asked about voting intentions. The analysis only covers polls concerning voting intentions for the Chamber of Deputies excluding those for the Senate⁶. In addition, we also include in the analysis those polls where the pollster did not specify which of the two branches of Parliament was being referred to.

Figure 5.1: 2008 Italian General Election polls for the five parties/coalitions over the six months of election campaign

y-axis = percentage support according to poll readings. x-axis = date n which poll readings were taken.



On this basis there were 86 polls for the Chamber of Deputies. Figure 5.1 presents the poll readings series for each coalition over the election campaign. According to

⁶Given the difference in the electoral system for the two chamber of Italian Parliament, we prefer to exclude from the analysis those polls referring to the Senate.

this, all predictions concerning the two major centre-right and -left coalitions fall within a range between 30% and 55% of the share. In contrast to 2006, the centre-right coalition (Popolo della Libertà) was leading the race on the basis of these predictions. The remaining parties had shares that were between 0% and 10% of the share.

What is interesting in this figure is that over the entire election campaign all the poll readings present an oscillating trend irrespective of the coalition they refer to.

Before proceeding with the discussion of the evidence provided by accuracy measures, it is necessary recall their main differences. When A' is applied, it produces an estimate of poll prediction for each party/coalition rather than an estimate of overall polls accuracy which is provided by A measure. As explained earlier, we revised the A measure in two versions in order to allow us to assess the extent of inaccuracy at the three Italian general elections. Doing so, we are also able to estimate whether there is a rising or decreasing trend in terms of extent of inaccuracy in Italian polling during the elections. The B_w gives information on the degree of error for each polls taking into account all the parties/coalitions in the electoral race.

Table 5.1: 2008 Italian General Election polls on Chamber of Deputies: comparison of percentage of inaccuracy applying A , A' , and B_w measures

The percentages for the A and A' measures refer to their values falling outside the 95% confidence interval. The A measure is computed considering only two parties/coalitions (PDL and PD) using the formula 3.1. The A' measures is computed using all the parties/coalitions competing the electoral (formula 5.1, A.5, A.7, A.6, and A.8). In the last two columns, the A' measures is computed using only three parties/coalitions competing the election (formula 5.3, A.13, and A.14). The percentages for the B_w measure refer to the proportion of their values that are statistically biased on the basis of the χ^2 test using $p \leq 0.05$ threshold. The B_w measure is computed using the formula 3.5.

| | Polls | | | | | Centre Right | | Centre Left | |
|-------------------|-------|-----|-----|-----|-----|--------------|-----|-------------|----|
| | | PDL | PD | UDC | SA | Others | | | |
| A | 29% | — | — | — | — | — | — | — | — |
| A' (3 parties) | — | — | — | — | — | 56% | 56% | 78% | — |
| A' (5 parties) | — | 42% | 22% | 35% | 98% | 55% | — | — | — |
| B_w (3 parties) | 65% | — | — | — | — | — | — | — | — |
| B_w (5 parties) | 98% | — | — | — | — | — | — | — | — |
| N | 86 | 86 | 86 | 85 | 85 | 86 | 86 | 86 | 86 |

Table 5.1 compares the percentage of polls classified as inaccurate where the first row reports the outcomes using the measure A , the second row reports the outcomes using the measure A' applied to three coalitions; the third row reports the outcomes using the measure A' applied to all coalitions and the last two rows document the total percentage of polls that are statistically biased using the χ^2 test for the B_w measure computed using three and five parties/coalitions respectively. For the sake of simplicity, we will discuss the results for each measure separately. Focusing on the first row where the measure A (formula 3.1) is applied, overall only 29% of polls are classified as inaccurate. Compared with 2006 (32%, see table 4.1), there is a slight decrease in inaccuracy. Moving to the second row where the first version of measure of A' (formula 5.3, A.13, and A.14) is applied, the percentage of inaccurate polls rises to 56, 78, and 56 for Popolo della Libertà, Partito Democratico, and Others respectively. Compared with the 2006 inaccuracy percentages, there was a significant decrease with regard to the centre left coalition and the group of small parties not aligned with any coalition: almost 20% fewer polls are classified as inaccurate (see table 4.1). Instead, this is not the case with the Centre - Right, where there is a slight decrease of 4% in the proportion of polls classified as inaccurate. On the basis of the outcomes reported in the third row of table 5.1 where the second version of measure A' (formula 5.1, A.5, A.6, A.7, and A.8) is applied, the percentages of polls that are inaccurate among all coalitions are 42, 22, 35, 98, and 55 for Popolo della Libertà, Partito Democratico, the Sinistra Arcobaleno, the UDC, and Others respectively. According to the literature, adding the predictions

for parties creates a more accurate forecast because this procedure decreases the error. However, the evidence provided by table 5.1 shows that when adding the poll readings of coalitions⁷ on the basis of their centre-right or -left orientation, the extent of inaccuracy rise in particular for the centre-left coalitions. In addition, the percentage of polls classified as inaccurate concerning the Others coalition does not change when using the two versions of A' . Concerning the B_w measure, there is a high percentage of polls that are statistically biased using the χ^2 test without regard to the number of parties/coalitions taken into account. Therefore, the B_w measure estimates a significant degree of error in Italian polling. Compared to the previous election, the percentage of statistically biased polls decreases from 76% to the 65% (see tables 4.1 and 5.1). As Castro and Tomaselli (2015) have pointed out, the B_w measure is highly sensitive to the number of parties/coalitions taken into account in the computation process. This is confirmed by table 5.1, which documents that the percentages of statistically biased polls rise by 20% using 5 rather than 3 parties/coalitions.

To look in more depth at the percentages of polls that are inaccurate, tables 5.2 and 5.3 compare the monthly averages and the percentages of poll predictions using A and second versions of A' and the first version of A' respectively. In the second column, table 5.2 reports the monthly averages and the percentages of polls that are statistically biased using the χ^2 test for the B_w measure.

⁷For the centre-right, we add the Popolo della Libertà and UDC poll readings. For the centre-left, we add Partito Democratico and Sinistra Arcobaleno poll readings.

Table 5.2: 2008 Italian General Election polls on Chamber of Deputies: monthly average and percentage of inaccuracy of A , A' , and B_w using all parties/coalitions

The percentages for the A and A' measures refer to their values falling outside the 95% of confidence interval. The A measure is computed considering only two parties/coalitions (PDL and PD) using the formula 3.1. The A' measures is computed using all the parties/coalitions competing the election (formula 5.1, A.5, A.7, A.6, and A.8). The percentages for the B_w measure refer to the proportion of their values that are statistically biased on the basis of the χ^2 test using $p \leq 0.05$ threshold. The B_w measure is computed using the formula 3.5.

* the values of A' over the given month are both positive and negative.

| | | Polls | | PDL | PD | UDC | SA | Others | |
|-----------------|---------|--------|-------|--------|--------|--------|--------|---------|------|
| | | A | B_w | A' | A' | A' | A' | A' | A' |
| October | average | -0.102 | 0.231 | 0.088 | -0.104 | -0.157 | -1.199 | -1.963 | |
| | % | 20 | 100 | 20 | 40 | 20 | 100 | 100 | |
| November | average | -0.072 | 0.289 | 0.025 | -0.108 | -0.441 | 0.976 | -2.212 | |
| | % | 0 | 100 | 0 | 33 | 67 | 100 | 100 | |
| December | average | -0.015 | 0.076 | 0.007 | -0.087 | 0.049 | 0.537 | -0.366* | |
| | % | 0 | 66 | 0 | 33 | 0 | 67 | 67 | |
| January | average | -0.036 | 0.381 | -0.062 | -0.118 | -0.598 | 0.765 | -1.243 | |
| | % | 20 | 100 | 40 | 100 | 100 | 100 | 100 | |
| February | average | -0.092 | 0.156 | -0.146 | -0.073 | -0.002 | 1.005 | -0.362 | |
| | % | 28 | 100 | 71 | 28 | 39 | 94 | 44 | |
| March | average | -0.11 | 0.123 | -0.168 | 0.018* | 0.180 | 0.926 | -0.277 | |
| | % | 35 | 100 | 63 | 10 | 31 | 100 | 46 | |

For the sake of simplicity, we will first discuss the evidence provided by table 5.2 and then that concerning table 5.3 for each coalition separately.

According to table 5.2, when the A measure is applied, there is an overall underestimation in Italian polling. In other words, the monthly average of A has negative values, but they are not significantly different from 0 (the perfect agreement between poll prediction and election results). In addition, the higher percentages of polls classified as inaccurate occurs closer to Election Day rather than further back. This is also confirmed by the B_w measure, where almost all the monthly percentage of statistically biased polls stand at 100% except in December when the proportion drops to 66%. Moreover, the monthly averages of the B_w measure decrease over the last two months of the election campaign. Regarding the major centre-right coalition, table 5.2 shows that there was a constant underestimation in the last part of the election campaign. In other words, 42% of those polls constantly underestimate the winner of the election. In addition, the monthly average of A' values is not so significantly different from 0 except in the last two months. Indeed, the monthly percentage of polls classified as inaccurate in the first three months (from October to December) of the election campaign is the same as the outcomes using the original A measure but assuming positive values not different from 0. Then, comparing the last three months (from January to March), those percentages are doubled and change their sign (from positive to negative), and the polls underestimate the major centre right coalition. Regarding the major centre-left coalition, table 5.2 shows that there was a constant underestimation during the election campaign. In addition, the val-

ues of A' are not so significantly different from 0 and, in particular, the last months are characterized by the presence of both positive and negative values. Looking at the timing of the inaccuracy, the percentages of polls classified as inaccurate are almost the same for each month except for January (100%) and March (10%)(see table 5.2). It should be also noted that the overall percentages using the second version of A' for the Partito Democratico is only 22%, therefore those monthly percentages comprise a small set of polls classified as inaccurate. Regarding the UDC coalition, table 5.2 shows that there was both an under- and overestimation in the polls, comprised in the monthly average of accuracy values. Indeed, until January the polls underestimated the electoral results except in December, where all polls are classified as accurate and the average of their values is significantly close to 0. In addition, although in the last two months of the election campaign there was an overestimation of this coalition, values of accuracy measure A' are not significantly different from 0 and this is also due to the presence of both positive and negative values over the month of March. The seventh column of table 5.2 reports the monthly average and percentage of values of accuracy measure A' applied to the small centre-left coalition Sinistra Arcobaleno. As already pointed out when discussing table 5.1, there was a seriously high percentage (98%) of polls classified overall as inaccurate with regard to this coalition. This is consistent with what emerges also from table 5.2, where the monthly average of accuracy values has a positive value significantly different from 0. In addition, almost throughout the entire election campaign the percentage of polls classified as inaccurate reaches 100%,

except in December where the average of accuracy values is also lower than the rest. Regarding the group of small parties not aligned with any coalition (Others), table 5.1 reports that an overall 55% of polls are classified as inaccurate. According to table 5.2, there was a constant and significant underestimation of those small parties throughout the election campaign. Specifically, all the monthly average of accuracy values are negative and significantly different from 0. Only in the last two months of the election campaign is the monthly average lower and closer to 0.

To look in more depth at these results, we report the values of the accuracy measures employed (A and A') and their confidence interval over the election campaign for the Popolo della Libertà and Partito Democratico. When the values fall outside the confidence interval, they are classified as inaccurate and vice versa.

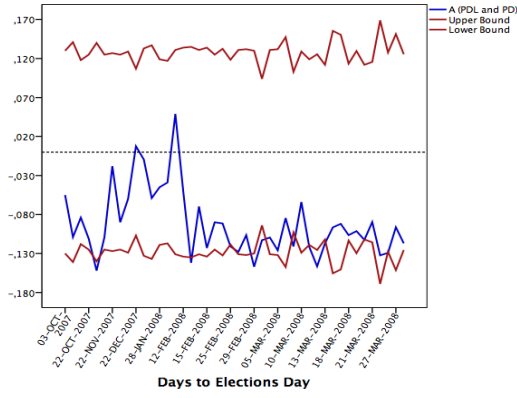
According to figure 5.2(a), the trend of values of A was unstable especially in the first part of the election campaign reaching a peak by the end of January assuming positive values and, then, dropping below the line of 0 in early February. In particular, the figure shows that although table 5.2 provided evidence that there were more polls classified as inaccurate in the last two months of the election campaign rather than in the previous months, all those polls date from late February and early March. Therefore, we may argue that in the very last days of the election campaign, when it is still possible to publish polls, their performance was accurate.

According to figure 5.2(b), the trend of values of A' for Popolo della Libertà was more unstable and oscillating than the overall accuracy values of the polls. During the first part of the election campaign, as the positive values for the accuracy

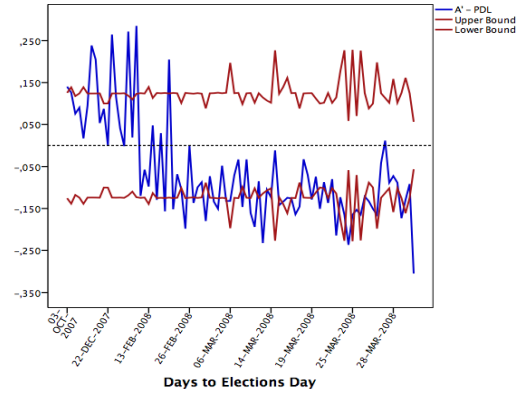
Figure 5.2: Accuracy values applying A and A' measures and their confidence intervals: Popolo delle Libertà and Partito Democratico

y-axis = accuracy values using the formula 3.1, 5.1 and A.5 for panel (a), (b), and (c) respectively.

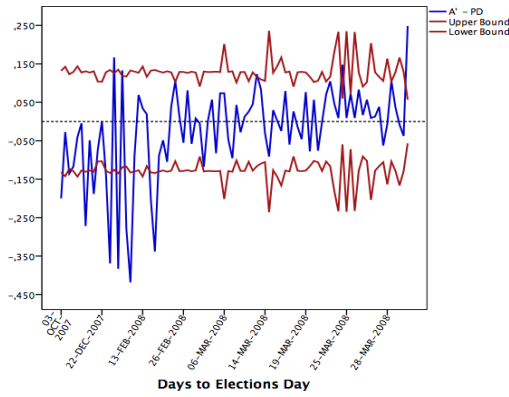
x-axis= dates on which poll readings are taken.



(a) A : PDL and PD



(b) PdL



(c) PD

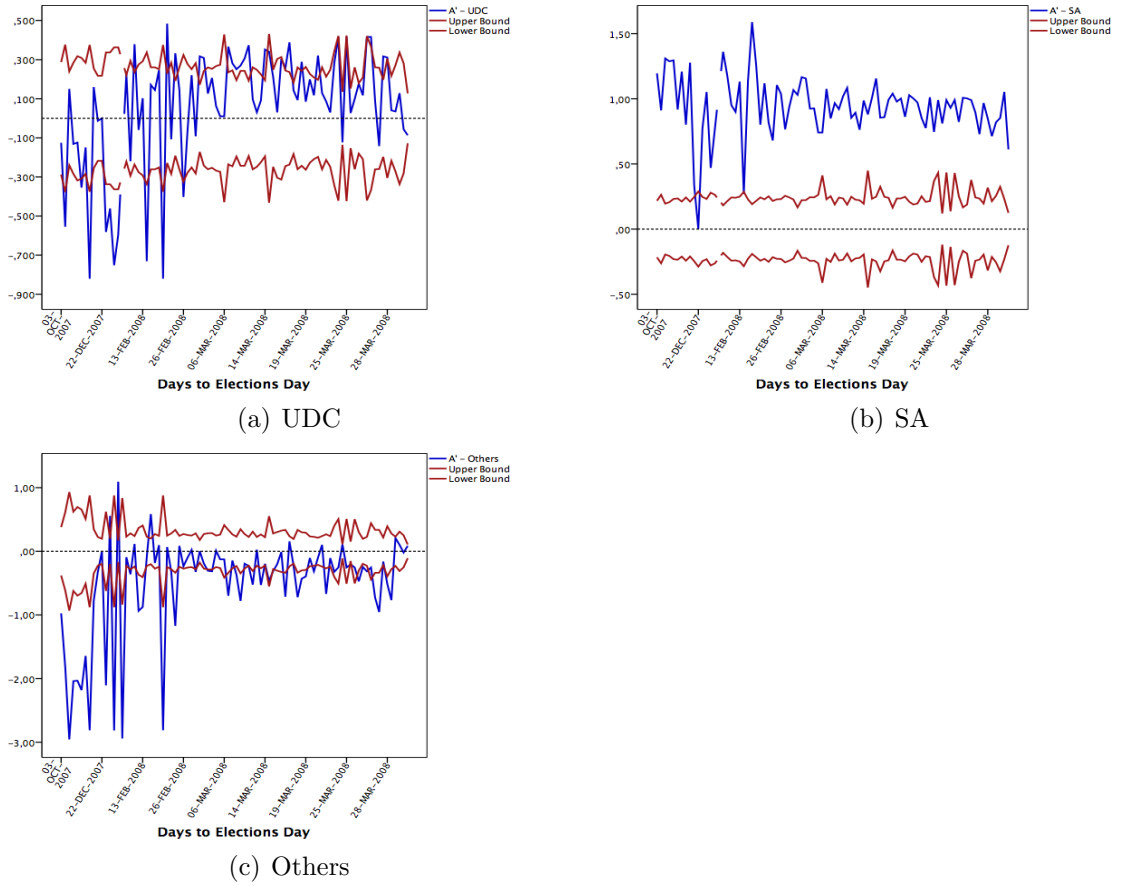
measure show, support for the Popolo delle Libertà has been overestimated. In contrast, the negative values for the accuracy measure in figure 5.2(b) show that from the second part of January, support for this coalition was underestimated. Only a few of these reach the 0 line (indicating perfect agreement between the poll readings and the election results).

Regarding the Partito Democratico, figure 5.2(c) shows that in the first part of the election campaign there are significant negative values for accuracy which

comprise the initial underestimation of this coalition in Italian polling. Closer to the beginning of February, the accuracy values become positive and, in a few cases, the values are very close to or overlapping the line of 0. In other words, in the last two months of the election campaign, polls were more accurate in predicting the electoral performance of the major centre-left coalition and, in some cases, they were also able to forecast correctly.

Figure 5.3: Accuracy values applying A' measures and their confidence intervals: UDC, SA, and Others

y-axis = accuracy values using the formula A.7, A.6, and A.8 for panel (a), (b), and (c) respectively.
x-axis = dates on which poll readings are taken.



With regard to the UDC party, figure 5.3(a) shows an oscillating trend which from a significant negative value in the first part of the election campaign rises

to a positive one but more accurate value especially in the last two months of the election campaign. Figure 5.3(b) clearly shows how strong the overestimation of this small centre-left coalition (SA) throughout the election campaign has been and there are only a few cases where the accuracy values fall inside the confidence interval, classifying them as accurate.

According to figure 5.3(c) concerning the Others coalition, from initial significant underestimation in the first two months of the election campaign, poll predictions become more accurate closer to Election Day and, in some cases, their accuracy values reach the line of 0.

Table 5.3 reports the outcomes computing the A' and B_w accuracy measures by considering only three coalitions. Specifically, the centre-right coalition has been obtained by adding the Popolo delle Libertà and UDC poll predictions whereas the centre-left coalition is composed of the Partito Democratico and Sinistra Arcobaleno poll predictions. Focusing on the B_w measure, the monthly averages decrease closer to Election Day. This is also confirmed by a lower percentage of statistically biased polls during the last two months of the campaign.

According to the A' measures, there was a constant underestimation comprised in the monthly negative average values for the centre right coalitions, except in December where there is the presence of both positive and accurate values. Figure 5.4(a) shows the values of the accuracy measure A' and its confidence interval for the centre-right coalition.

In contrast to the previous outcomes concerning the Popolo delle Libertà and

Table 5.3: 2008 Italian General Election polls on Chamber of Deputies: monthly average and percentage of inaccuracy of A' and B_w using three coalitions.

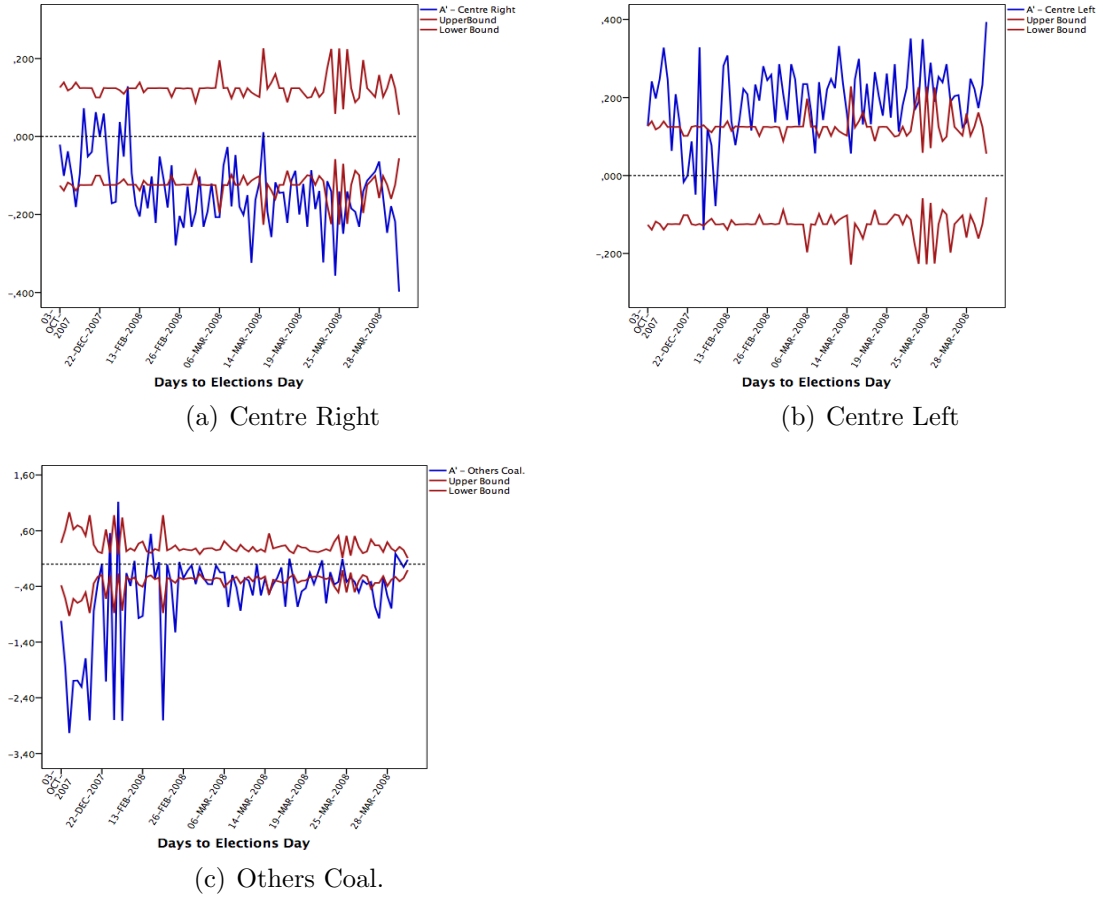
The percentages A' measures refer to their values falling outside the 95% confidence interval. In the last three column, the A' measures is computed using only three parties/coalitions competing the election (formula 5.3, A.13, and A.14). The percentages for the B_w measure refer to the proportion of their values that statistically biased on the basis of the χ^2 test using $p \leq 0.05$ threshold. The B_w measure is computed using the formula 3.5.

* the values of A' over the given month are both positive and negative.

| | | Centre-Right | Centre-Left | Others | B_w |
|-----------------|---------|--------------|-------------|--------|-------|
| October | average | -0.088 | 0.228 | -2.012 | 0.234 |
| | % | 20 | 100 | 100 | 100 |
| November | average | -0.025 | 0.172 | -2.234 | 0.252 |
| | % | 0 | 67 | 100 | 100 |
| December | average | 0.007* | 0.039 | 0.297 | 0.057 |
| | % | 0 | 33 | 67 | 66 |
| January | average | -0.061 | 0.069 | -1.209 | 0.236 |
| | % | 40 | 60 | 100 | 100 |
| February | average | -0.140 | 0.178 | -0.401 | 0.116 |
| | % | 67 | 72 | 44 | 50 |
| March | average | -0.167 | 0.212 | -0.323 | 0.113 |
| | % | 63 | 83 | 48 | 60 |

Figure 5.4: Accuracy values applying A' measures and their confidence intervals: Centre Right and Centre Left Coalition

y-axis = there are the accuracy values using the formula 5.3, A.13, and A.14 for panel (a), (b), and (c) respectively.
x-axis = dates on which poll readings were taken.



the UDC separately, this figure shows that the polls were more accurate in predicting the electoral outcomes of centre-right coalition in the last part of the election campaign. In other words, closer to Election Day, more polls are classified as accurate. Regarding the centre-left coalition, table 5.3 shows that there was a constant overestimation even if the monthly average of accuracy values is not so significantly different from 0. This is consistent with what has already emerged from the previous table 5.2 concerning both the coalitions separately. Indeed, the monthly averages of

accuracy values for the Partito Democratico coalition are negative and, conversely, the monthly averages for the Sinistra Arcobaleno are significantly positive. In other words, the monthly positive average accuracy values are due to the significant positive values for the Sinistra Arcobaleno rather than the better accuracy performance of poll predictions concerning the Partito Democratico. This is also consistent with the overall percentage of polls which rise up to 78% (see table 5.1) due to the 98% of poll predictions classified as inaccurate for the Sinistra Arcobaleno. Figure 5.4(b) shows the values of the accuracy measure A' and its confidence interval for the centre-left coalition.

The trend of accuracy values present in figure 5.4(b) is very similar to figure 5.3(b) for the Sinistra Arcobaleno. In other words, it can easily be seen that all the accuracy values are positively outside the confidence interval especially in the last part of the election campaign and there are only a few cases with negative but accurate values. The last column of table 5.3 reports the outcomes of accuracy values of measure A' applied to Others as the third coalition. The outcomes do not change very much from table 5.2. In other words, there is a constant underestimation of these small parties throughout the election campaign. In addition, the monthly percentage of polls classified as inaccurate is also the same as that reported in table 5.2. This is also confirmed by figure 5.4(c), which shows the accuracy values and confidence interval.

Comparing figures 5.3(c) and 5.4(c), we do not notice remarkable differences between them. Therefore, using two different versions of accuracy measure A' provides

the same results with regard to the Others coalition, where there was a significant underestimation in the first part of the election campaign. Conversely, in the last two months closer to Election Day, there was less significant overestimation and, therefore, a more accurate poll predictions.

5.3 House Effect Results

In the previous section, we showed that in the 2008 Italian general election there was a slight decrease in the overall percentage of inaccurate poll readings and also with regard to each party/coalition. Indeed, this has been confirmed by the different versions of the revised accuracy measure A' employed. Specifically, all the coalitions have been underestimated during the last election campaign with few exceptions. For instance, the small centre left coalition, Sinistra Arcobaleno, has been highly overestimated over the entire election campaign. In addition, adding its poll predictions to the major centre-left coalition (Partito Democratico) in order to reduce the error and to compare its performance with other elections, it had the worst overall poll performance in terms of predicting the centre-left coalitions electoral outcome. Therefore, what causes this high percentage of inaccuracy? In this thesis, two hypotheses have been described concerning the causes of inaccuracy: the house effect and voters sentiment change. In this section, we undertaken a statistical analysis of the house effect. The latter refers to biases caused by the methodologies employed by different polling institutions.

The model proposed by Erikson and Wlezien (1999) assumes that the variance of poll readings from one day to the next is caused by the house effect. To estimate it, they regress with no intercept the poll readings in a set on $N-1$ polling houses and k dummy variables for each day with at least one poll readings (see formula 3.6). The coefficient of day dummy variables expresses the house effect. In addition, they employ the lowess procedure proposed by Cleveland (1979) to estimate the presence of random error in the series. In order to estimate which methodology used by polling houses most affects the predictive accuracy of Italian polling, we employ a multivariate regression model where the A , A' and B_w are the dependent variables (see formula 3.15).

5.3.1 Findings

As for the accuracy measures, the house effect model proposed by Erikson and Wlezien (1999) has been drawn on the basis of the American system. Therefore, to fit with the Italian case, we apply the OLS to each party/coalition. In other words, we will regress the poll readings for each coalition on a set of 22 dummy polling houses variables ($N - 1$) and 47 dummy variables for each day with at least one poll reading. Then, we will apply the lowess procedure in order to estimate the amount of random error in the series. Applying this model to each coalition will allow us to estimate the house effect separately. In other words, it may be possible that the methodologies employed by different polling houses may affect one coalition more than others. Tables 5.4 and 5.5 present the outcomes of three models to investigate

the house effect for the 2008 general election. Specifically, the first table (5.4) refers to the models using the poll readings for each coalition as dependent variables. In contrast, the second table (5.5) reports the models using the values of A , A' and B_w as dependent variables. As already explained in the previous chapter devoted to the 2006 general election, the reason for using the accuracy values measures as dependent variables lies with the main purpose of investigating the causes of inaccuracy in depth. In other words, to explain why the Italian polls were inaccurate in 2008 general election, using the values of A , A' , and B_w as dependent variables rather than the poll readings allows us to estimate their variance over the days due to the house effect. Moreover, this procedure allows us to examine in more depth how much of the variance of inaccuracy values is specifically due to the house effect. Recalling the expectation, the variance of days and houses explains the variance of poll readings and accuracy values, that is their inaccuracy. We will discuss the results of poll readings and accuracy values as dependent variables separately.

Table 5.4: 2008 Italian General Election polls on Chamber of Deputies: House Effect analysis using OLS regression with no intercept and poll readings as dependent variable

The OLS regression model refers to the formula 3.12. The last two column refer to the share of PDL plus UDC and PD plus SA respectively.

(*) The statistical level of significance for the ANOVA test follows the rule: 1% = $p < 0.01$; 5% = $p < 0.05$; 10% = $p < 0.10$

| | PDL | UDC | PD | SA | Others | Centre-Right | Centre-Left |
|---------------------------------|-------|-------|-------|-------|--------|--------------|-------------|
| Model 1: Days | | | | | | | |
| R^2 | 0.98 | 0.98 | 0.98 | 0.97 | 0.96 | 0.98 | 0.98 |
| Adjusted R^2 | 0.97 | 0.95 | 0.97 | 0.93 | 0.93 | 0.97 | 0.97 |
| ANOVA* (sign.) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Model 2: Houses | | | | | | | |
| R^2 | 0.97 | 0.96 | 0.97 | 0.97 | 0.83 | 0.97 | 0.97 |
| Adjusted R^2 | 0.96 | 0.95 | 0.96 | 0.96 | 0.77 | 0.96 | 0.96 |
| ANOVA* (sign.) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Model 3: Days and Houses | | | | | | | |
| R^2 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 |
| Adjusted R^2 | 0.97 | 0.97 | 0.98 | 0.96 | 0.97 | 0.97 | 0.98 |
| ANOVA* (sign.) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Table 5.4 reports the outcomes of OLS regression using the poll readings for each coalition as dependent variables. In addition, the last two columns of the table report the outcomes for the centre-right coalition obtained by adding the Popolo della Libertà and UDC poll readings and for the centre-left coalition obtained by adding the Partito Democratico and Sinistra Arcobaleno poll readings. For the sake of simplicity, the discussion of the evidence provided by table 5.4 will be presented for each model separately. Concerning the first model where the poll readings are regressed only on dummy days variables, all the *Adjusted R²* are higher than 0.93, meaning the variance of these poll readings depends almost completely on the variance of days. What is most interesting is that the *Adjusted R²* of centre-right and -left coalitions are the same as for the Popolo della Libertà and the Partito Democratico, which are the two major coalitions of the centre- right and centre-left coalitions respectively. Instead, the lower *Adjusted R²* belongs to the three small coalitions of UDC, Sinistra Arcobaleno, and Others. Comparing these outcomes with those in the 2006 general election, all the coalitions seem to be more affected by the variance of days than in the previous election (see table 4.3), especially, the *Adjusted R²* concerning the Others coalition, which rises from 0.65 up to 0.93. In the second model, the poll readings are regressed only on dummy polling houses variables. As for the previous model, table 5.4 provides evidence of a high *Adjusted R²* , which varies between 0.78 and 0.96. Indeed, in this model the Others coalition is also affected less by the house effect than the rest of the coalitions. In addition, these results are higher than the 2006 poll readings (see table 4.3). In the third

model, we fully apply the model proposed by Erikson and Wlezien (1999) regressing the poll readings on the days and polling houses dummy variables. As reported in table 5.4, the *Adjusted R²* varies between 0.96 and 0.98. Therefore, there is strong evidence that in 2008 the poll readings were affected by the methodologies employed by several polling houses on different days. In the light of this evidence, one of the hypotheses of this thesis has been strongly confirmed by all the models employed. Moreover, all these outcomes provided stronger evidence of house effect in the 2008 Italian polling than in the previous election.

Table 5.5 reports the outcomes using the accuracy values for each coalition as dependent variables. Specifically, the first panel of the table refers to the accuracy values (A') applying the formula 5.1, A.5, A.6, A.7, and A.8 (see Appendix) and B_w measure. The second panel of the table refers to the accuracy values applying the formula 5.3, A.13, and A.14 (see Appendix) and B_w measure. The third panel refers to accuracy values applying the A measure (formula 3.1). For the sake of simplicity we will discuss the evidence provided in table 5.5 for each model separately as for the previous table.

Table 5.5: 2008 Italian General Election polls on Chamber of Deputies: House Effect analysis using OLS regression with no intercept and polls' accuracy as dependent variable

In the first panel, the dependent variable is the accuracy values series for the given party/coalition using the formula 5.1, A.5, A.7, A.6, and A.8 respectively. The OLS regression model refers to the formula 3.13. The column called ' B_w ' refers to the error estimated series using the formula 3.5 taking into account all the parties/coalitions competing the election. The OLS regression model refers to the formula 3.14. In the second panel, the dependent variable is the accuracy values series using the formula 5.3, A.13, and A.14. The column called ' B_w ' refers to the error estimated series using the formula 3.5 taking into account only three parties/coalitions competing the election. The column called ' A ' refers to the accuracy values series computed using the formula 3.1 (PDL and PD) as dependent variable.
 (*) The statistical level of significance for the ANOVA test follows the rule: 1% = $p < 0.01$; 5% = $p < 0.05$; 10% = $p < 0.10$

| PDL PD UDC SA Others B_w | | | | | | | | | | Centre-Right Centre-Left Others B_w A | | | |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---|--|--|--|
| | | | | | | | | | | | | | |
| Model 1: Days | | | | | | | | | | | | | |
| R^2 | 0.90 | 0.76 | 0.78 | 0.96 | 0.94 | 0.76 | 0.88 | 0.94 | 0.70 | 0.93 | | | |
| Adjusted R^2 | 0.79 | 0.49 | 0.54 | 0.92 | 0.88 | 0.50 | 0.76 | 0.87 | 0.38 | 0.85 | | | |
| ANOVA* (sign.) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | | |
| | | | | | | | | | | | | | |
| Model 2: Houses | | | | | | | | | | | | | |
| R^2 | 0.61 | 0.34 | 0.83 | 0.96 | 0.64 | 0.72 | 0.80 | 0.85 | 0.69 | 0.85 | | | |
| Adjusted R^2 | 0.49 | 0.12 | 0.78 | 0.95 | 0.52 | 0.62 | 0.70 | 0.79 | 0.54 | 0.80 | | | |
| ANOVA* (sign.) | 0.000 | 0.102 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | | |
| | | | | | | | | | | | | | |
| Model 3: Days and Houses | | | | | | | | | | | | | |
| R^2 | 0.96 | 0.94 | 0.96 | 0.98 | 0.99 | 0.91 | 0.97 | 0.97 | 0.85 | 0.98 | | | |
| Adjusted R^2 | 0.85 | 0.76 | 0.83 | 0.95 | 0.97 | 0.65 | 0.89 | 0.95 | 0.40 | 0.94 | | | |
| ANOVA* (sign.) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | | |

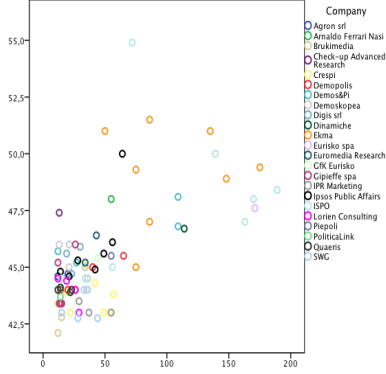
In the first model (dummy days as explanatory variables), *Adjusted R*² varies between 0.49 and 0.92. Specifically, the lower accuracy values affected by the days are the Partito Democratico and the UDC. This is consistent with the evidence provided by accuracy analysis presented in the previous section (see table 5.1), where the poll readings throughout the election campaign for those coalitions are the most accurate in the sample. Moreover, the outcomes of this model are in line with the accuracy analysis results for the other two points. Firstly, the accuracy values of Sinistra Arcobaleno are the most affected by the variance of days and its poll predictions are the most inaccurate in the sample (see table 5.1). Secondly, the performance of accuracy of poll prediction concerning the Others coalition does not change when the *A'* measure is employed and *Adjusted R*² of Others coalition does not change in panel 1 and 2. In the second model (dummy polling houses as explanatory variables), values of *Adjusted R*² vary more than in the previous model: 0.12 (Partito Democratico) and 0.95 (Sinistra Arcobaleno). Also in this model, these results are consistent with the evidence provided by accuracy analysis and explained above. With this in mind, we can argue that in 2008 the accuracy values of poll readings are less affected by different polling houses than in the previous election. However, this could also be due to (slightly) better performance in terms of accuracy of the 2008 poll readings than in 2006. Indeed, focusing only on the outcomes reported in the second and third panels in table 5.5, the *Adjusted R*² varies between 0.54 and 0.80. In other words, the accuracy values of centre-right and -left coalitions and the overall performance of poll readings are more affected

by the polling houses than the accuracy values for each coalition separately. In the third model (dummy days and polling houses as explanatory variables), the *Adjusted R²* varies between 0.40 and 0.96 in all the accuracy values. Therefore, the accuracy values of poll readings for each coalition, centre -right and -left coalition, and the overall performance of poll readings are more affected by the variance of both days and polling houses than in the other two models applied. Moreover, all the regressions using the three models meet the highest level of significance and, therefore, it may possible to draw substantial and reliable conclusions. According to this evidence, the hypothesis concerning the house effect as the main causes of inaccuracy in Italian polling has been confirmed by all the models employed.

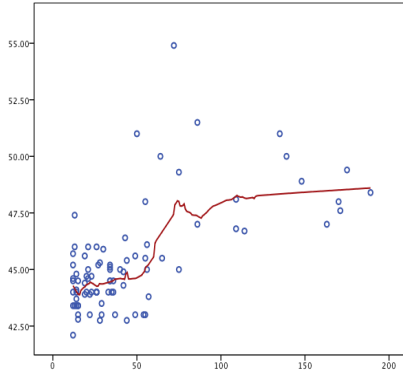
Figure 5.5 shows the correlation between the house-adjusted poll readings for Popolo della Libertà and the number of days between the poll readings and Election Days using linear and smoothed scatter plots. According to 5.5(a) there is a positive correlation between the number of days and the house effect in poll readings, confirming the previous analysis. Despite the high variance explained by the house effect in all coalitions, the previous analysis also shows a certain amount of error. In order to estimate the latter among the house-adjusted series for each coalition, we will employ the well-established statistical procedure designed by Cleveland (1979), which is known as *lowess*. Recalling this procedure, it has the merit of creating a new value for each point in time based on the outcomes of regression using a designed number of surrounding data points (Cleveland 1979; Beck and Jackman 1998). In other words, it is a procedure that better fits the line following the trend

Figure 5.5: Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Popolo delle Libertà

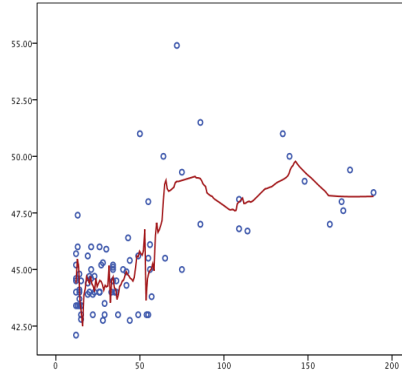
y-axis = house-adjusted polls the poll readings. x-axis = number of days remaining before Election Day.
The smoothed scatter plot is computed following the model 3.7.



(a) Linear



(b) Smoothed: Bandwidth = 0.30



(c) Smoothed: Bandwidth = 0.10

of regression results. The new values are generated using weighted predicted values based on their temporal distance from a specific point in question. The degree to which the line follows the data depends on the bandwidth used to generate the smoothed values. The lower the bandwidth, the more the fitted line represents the random error. We will apply the following bandwidths for each smoothed house-adjusted series: 0.40, 0.30, 0.20, and 0.10 ⁸. For the sake of simplicity, we report

⁸We also applied the bandwidth 0.05, which is considered the most robust in order to estimate the random error, but all the scatterplots obtained were illegible because the fitted lines were outside the box figure. Please refer to the Appendix for the smoothed scatterplot with bandwidth 0.40 and 0.20.

only the smoothed scatterplot using the bandwidths of 0.30 and 0.10 given that they generate better fitted lines for the purpose of this thesis.

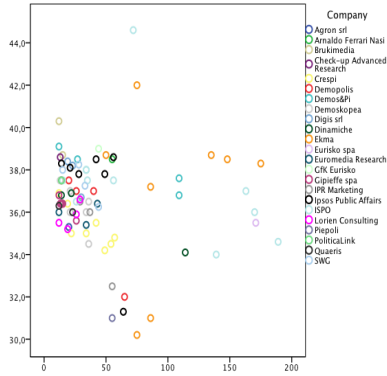
As for the other analysis presented in this chapter, the outcomes provided by the linear and the smoothed plots of the house-adjusted series will be presented for each coalition separately.

The bottom right panel (5.5(c)) shows the fitted line using the bandwidth of 0.10, which is able to follow the series presenting lower random error. Indeed, the bottom left panel 5.5(b) with the higher bandwidth shows a less sensitive smoothed series in representing the random error. Therefore, the outcomes of the lowess procedure for the Popolo della Libertà provide evidence that the inaccuracy of poll readings is also due to a certain amount of random error rather than only a strong presence of the house effect.

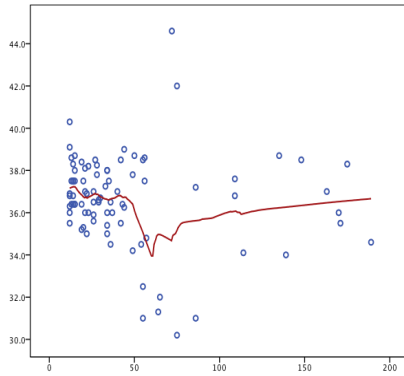
Figure 5.6 shows the correlation between the house-adjusted poll readings for Partito Democratico and the number of days between poll readings and Election Day. According to figure 5.6(a), there is a slightly positive correlation especially in the last 60 days of the election campaign. Specifically, all the values for the last two months vary between 36% and 40% of the share. In the first part of the election campaign, the house-adjusted poll readings present higher dispersion varying between 30% and 44% of the share. Therefore, the bigger the difference between the Election Day and the poll readings, the higher is the dispersion among them. This is also consistent with the evidence provided by the accuracy (see table 5.1) and house effect analysis (see tables 5.4 and 5.5).

Figure 5.6: Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Partito Democratico

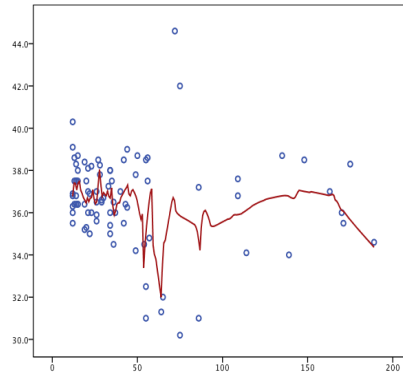
y-axis = house-adjusted polls the poll readings. x-axis = number of days remaining before Election Day.
The smoothed scatter plot is computed following the model 3.7.



(a) Linear



(b) Smoothed: Bandwidth = 0.30



(c) Smoothed: Bandwidth = 0.10

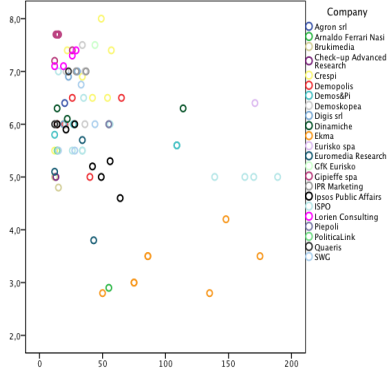
Using the lowess procedure, the series presents a similar pattern to the Popolo delle Libertà. In this case too, the lower is the bandwidth, the more the new values created by the smoothed version follow the house-adjusted series (5.6(c))⁹. However, figures 5.6 show a high presence of random effect in the series. In the light of this evidence, we may argue that the inaccuracy of poll readings may be due more to other factors than the house effect estimate in the previous analysis. This

⁹In addition, the other series created using higher bandwidth (0.40, 0.30, and 0.20) are very similar to each other, which means that none of them are able to estimate correctly the degree of random error in the Partito Democratico house-adjusted series. Please refer to the Appendix for figures.

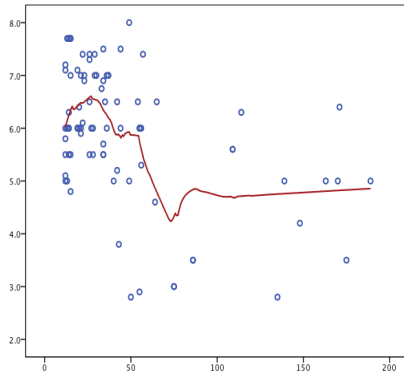
is consistent with the better performance of polls in terms of accuracy and the high degree of random error estimated among the house-adjusted series.

Figure 5.7: Linear and smoothed scatter plots of house-adjusted polls aggregated by date: UDC

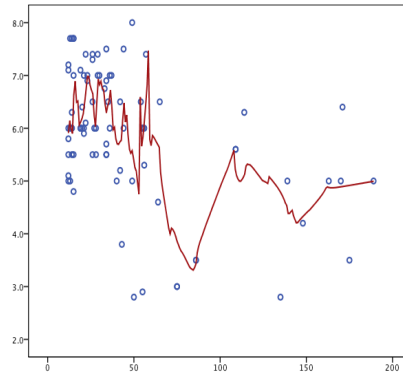
y-axis= house-adjusted polls the poll readings. x-axis = number of days remaining before Election Day. The smoothed scatter plot is computed following the model 3.7.



(a) Linear



(b) Smoothed Bandwidth = 0.30



(c) Smoothed Bandwidth = 0.10

Figure 5.7(a) shows the correlation between the house-adjusted polls reading for the UDC and the number of days between poll readings and Election Day. As can be easily seen, there is a lot of dispersion among the house-adjusted poll readings, especially in the first part of the election campaign. Indeed, the poll readings vary between 2.5% and 6% of the share. However, the story does not change so much also in the last two months of the election campaign, where the poll readings vary

between 3% and 8% of the share. Therefore, it is not possible to draw any substantial and clear relationship between them. In the light of this, we will apply the lowess procedure to estimate the degree of random error in the house-adjusted series for the UDC.

The bottom right panel of figure 5.7(c) shows that using the bandwidth of 0.10 the new values created by the smoothed version are highly sensitive in terms of following the house-adjusted series. In other words, the bottom right panel estimates better the degree of random error in the series of UDC. According to this, we may draw the conclusion that the inaccuracy of poll readings is also due to factors other than just the house effect.

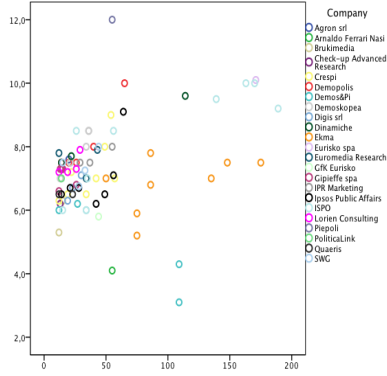
Figure 5.8 shows the correlation between the house-adjusted poll readings for Sinistra Arcobaleno and the number of days between the poll readings and Election Day using linear and smoother scatter plots. More than in the other coalitions, figure 5.8(a) shows a positive correlation between them: as the number of days decreases, so too does the house effect in poll readings.

Indeed, the first part of the election campaign contains a higher presence of dispersion among the house-adjusted poll readings.

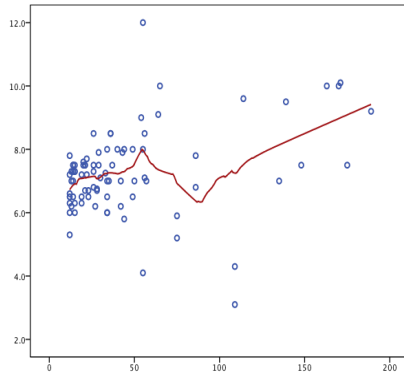
Therefore, we apply the lowess procedure in order to estimate the degree of random error in the house-adjusted poll readings for the Sinistra Arcobaleno. In the bottom right panel (5.8(c)), the new values created by the smoothed version allows us to estimate the random error in the series. In other words, the smoothed series follows closely the house-adjusted series presenting lower random error compared

Figure 5.8: Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Sinistra Arcobaleno

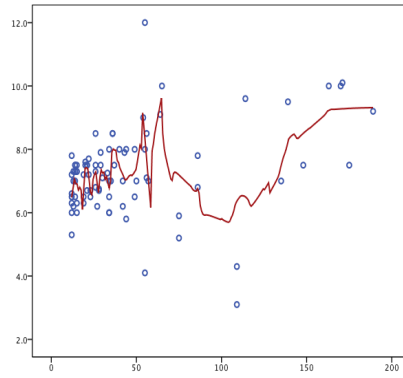
y-axis = house-adjusted polls the poll readings. x-axis = number of days remaining before Election Day.
The smoothed scatter plot is computed following the model 3.7.



(a) Linear



(b) Smoothed: Bandwidth = 0.30



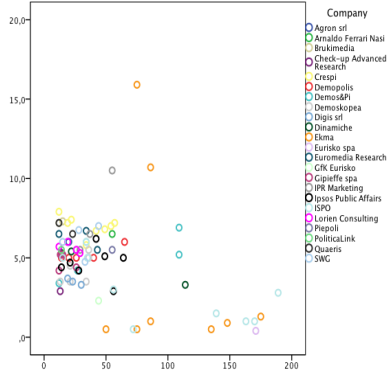
(c) Smoothed: Bandwidth = 0.10

with the other smoothed series (5.8(b)). With this in mind, we may argue that the poll readings for the Sinistra Arcobaleno were greatly affected by the house effect even if there is a small degree of random error - which could be due to other factors.

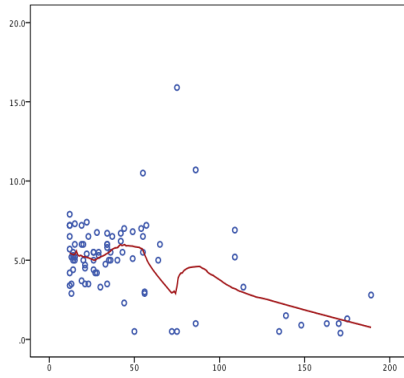
Figure 5.9(a) shows the correlation between the house-adjusted poll readings for the Others coalition and the number of days between the poll readings and Election Day. According to this figure, there is a negative relationship between them: when the number of days decreases, the house effect among poll readings and their dispersion increases.

Figure 5.9: Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Others

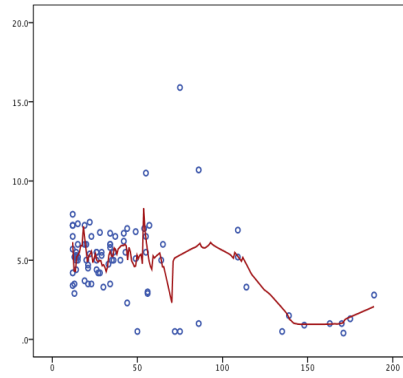
y-axis = house-adjusted polls the poll readings. x-axis = number of days remaining before Election Day.
The smoothed scatter plot is computed following the model 3.7.



(a) Linear



(b) Smoothed: Bandwidth = 0.30



(c) Smoothed: Bandwidth = 0.10

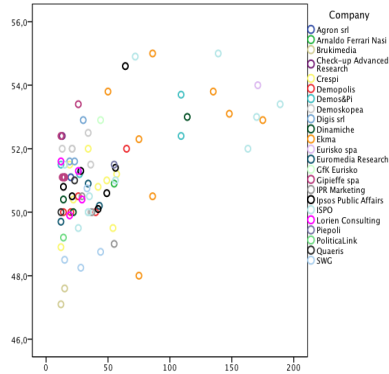
According to figure 5.9(b), the bandwidth of 0.30 is not able to estimate the random error among the house-adjusted series. Conversely, the bottom right panel 5.9(c) shows the presence of random error. However, we cannot exclude the hypothesis that the inaccuracy of polls is also due to factors other than the house effect on the basis of the random error estimated by the smoothed series.

Figure 5.10 shows the correlation between the house-adjusted poll readings for the centre-right¹⁰ coalition and the number of days between the poll readings and

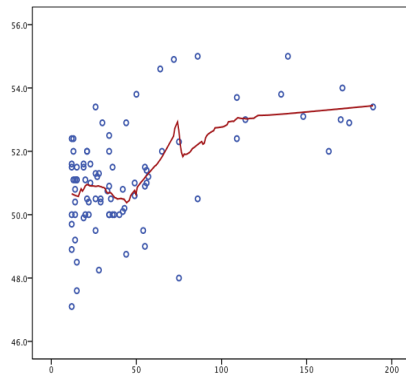
¹⁰As already explained earlier, the centre right coalition is obtained adding the Popolo delle

Figure 5.10: Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Centre Right Coalition

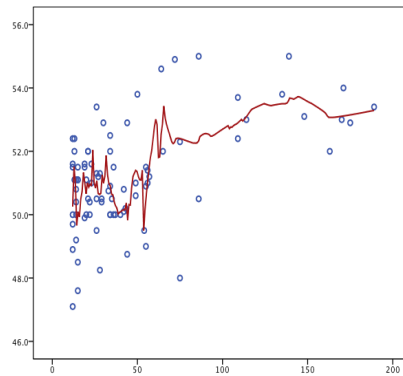
y-axis= house-adjusted polls the poll readings. x-axis = number of days remaining before Election Day.
The smoothed scatter plot is computed following the model 3.7.



(a) Linear



(b) Smoothed: Bandwidth = 0.30



(c) Smoothed: Bandwidth = 0.10

Election Day using linear and smoothed scatter plots. According to this figure, there is a high presence of dispersion in the series. However, we may draw a slightly positive relationship between the house-adjusted poll readings and the number of days between the latter and Election Day.

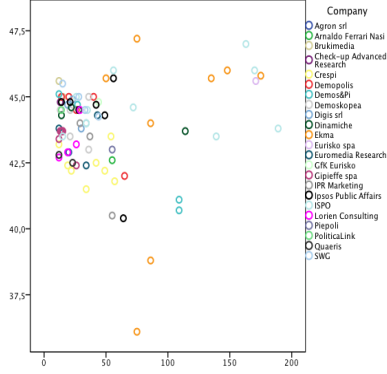
As figures 5.10(b) and 5.10(c) show, only the lower bandwidth (0.10) is able to follow sensitively the house-adjusted series more than the other three series. However, all the smoothed versions estimate a high presence of dispersion that may

Libertà and UDC poll readings.

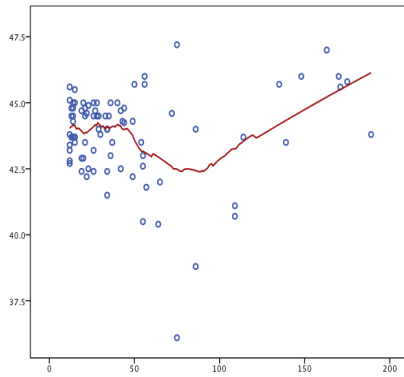
allow us to argue that other factors affected the accuracy of poll readings jointly with the house effect.

Figure 5.11: Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Centre Left Coalition

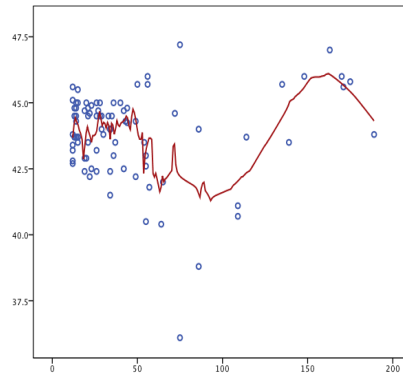
y-axis = house-adjusted polls the poll readings. x-axis = number days remaining before Election Day. The smoothed scatter plot is computed following the model 3.7.



(a) Linear



(b) Smoothed: Bandwidth = 0.30



(c) Smoothed: Bandwidth = 0.10

Figure 5.11(a) shows the correlation between the house-adjusted poll readings for the centre-left¹¹ coalition and the number of days between the poll readings and Election Day. According to this figure, there is a slightly positive relationship between them even if there is a high presence of dispersion in the series. Indeed, in

¹¹As already explained earlier, the centre-left coalition is obtained by adding the Partito Democratico and Sinistra Arcobaleno poll readings.

the last part of the election campaign the poll readings vary between the 40% and 47% of the share.

Using the lowess procedure, the series presents a similar pattern to the house-adjusted series. According to figures 5.11(b) and 5.11(c), there is a certain degree of random error in the series using different bandwidths (0.30 and 0.10). Moreover, the bottom right panel (5.11(c)) shows that the smoothed version using the bandwidth 0.10 is more able to estimate the random error in the series. As for the other coalitions, the other panel (5.11(b)) presents a smoothed version which is less sensitive and unable to estimate the random error. With this in mind, we may argue that also in this case the degree of random error presented in the smoothed version of the house-adjusted series for the centre-left coalition suggests that other factors may affect the accuracy of polls jointly with the strong house effect estimated in the previous analysis.

According to the aim of this thesis - to ascertain the factors that cause bias in Italian polling - we employ a multivariate regression model using the methodologies used by different polling houses as explanatory variables (see model 3.15). Recalling the model, we regress the accuracy index on a set of dummy variables for each methodology employed as documented by the polling house and an exogenous variable (the difference between the two main parties/coalitions as reported by poll readings) to estimate the house effect. Specifically, we take into account the sampling procedure (random and no-random), the delivery method (CATI¹²), who

¹²In contrast to the 2006 Italian general elections, none of polling houses reported using the CAWI delivery system. Therefore, we do not include its dummy variable in the models.

commissioned the poll (media, polling house, and political parties) and where its results have been disseminated (TV, newspapers, and the Internet). For each dummy variable we expect a different relationship with the accuracy index. Accordingly, the main expectations are a positive relationship between the accuracy index and the following variables: no-random samples, CATI, media and political parties as buyers, and the difference between the two main parties/coalitions estimated in the poll readings (hereafter referred to as DCEP). For instance, the use of no-random sample increases the inaccuracy (error) of poll readings¹³. For the rest, we expect a negative relationship and, therefore, these variables increase (decrease) the accuracy (error) in Italian polling. For the sake of simplicity, the results will be discussed separately for each accuracy measure. Table 5.6 reports the outcomes of this model applied to the 2008 Italian General Elections using the two overall accuracy indexes A and B_w as dependent variables.

We start by considering the model where B_w is the dependent variable. According to table 5.6, the only methodologies that meet the level of significance and, therefore, affect the error estimated in polls are the use of the CATI delivery system. This also occurs when using only three parties/coalitions to compute the B_w measure. Specifically, there is a significant relationship between the CATI delivery system and the overall error estimated (see table 5.6) fulfilling the expectation.

Regarding the model where A is the dependent variable, the predictive accuracy of polls is affected by the Newspapers and DCEP variables. In other words,

¹³Please refer to section 3.3.1 of chapter 3 for further explanation.

Table 5.6: House effect across the 2008 Italian General Election polls on Chamber of Deputies: Multivariate Regression model using A and B_w measures as dependent variables

The model is computed using formula 3.15, where set of methodologies employed by the polling house and the difference between the two major party/coalitions (referred as DCEP) are the explanatory variables. The A and B_w measures used as dependent variables are computed using the formula 3.1 and 3.5. The standard errors for the coefficient are in parentheses and the statistical level of significance follows the rule: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

| | B_w - 5 Par./Coal. | B_w - 3 Part./Coal. | A |
|------------------|--------------------------|--------------------------|-----------------------------|
| Random | 0.027 (0.063) | 0.010 (0.063) | 0.006 (0.008) |
| CATI | 0.030* (0.087) | 0.152* (0.088) | 0.017 (0.010) |
| B: Media | 0.204 (0.200) | 0.204 (0.200) | 0.028 (0.024) |
| B: Polling House | 0.227 (0.198) | 0.227 (0.198) | 0.024 (0.024) |
| M: TV | 0.041 (0.112) | 0.041 (0.112) | -0.008 (0.013) |
| M: Newspaper | -0.127 (0.103) | -0.127 (0.103) | -0.025** (0.012) |
| M: Internet | -0.010 (0.103) | -0.010 (0.103) | -0.004 (0.012) |
| DCEP | 0.016 (0.011) | 0.016 (0.011) | 0.013*** (0.001) |
| Constant | -0.026 (0.224) | -0.127 (0.226) | -0.244*** (0.027) |
| R^2 | 0.107 | 0.138 | 0.624 |
| Adjusted R^2 | 0.014 | 0.049 | 0.585 |
| ANOVA | 0.338 | 0.155 | 0.000 |

the dissemination of the poll results using newspapers decreases its inaccuracy ($\beta = -0.025$ $p < 0.05$). However, the higher the difference between the two main parties/coalitions estimated by poll readings, the higher is the predictive inaccuracy ($\beta = 0.013$ $p < 0.01$). These results are consistent with expectations.

Table 5.7 reports the outcomes of the multivariate regression model applied to A' measures for all the parties/coalitions as dependent variables. As with the other analysis, we discuss the results for each coalition separately.

We start by considering the outcomes of the model where the A' measure for Partito delle Libertà coalition is the dependent variable. According to table 5.7, the predictive accuracy for this coalition has been affected by the following variables: CATI, Media (as buyer), Polling Houses, and DCEP. Specifically, use of the CATI delivery system increases the predictive accuracy of polls for the Partito delle Libertà coalition ($\beta = 0.047$ $p < 0.05$). As for the A measure, the higher the difference estimated in the poll readings between this coalition and the Partito Democratico, the higher the predictive inaccuracy ($\beta = 0.032$ $p < 0.01$). Conversely, table 5.7 reports that when the poll is commissioned by the media and it is carried out under the Polling House's own initiative, its predictive accuracy increases. This evidence is in line with our main expectations.

As regard the model where the A' measure for the Partito Democratico coalition is the dependent variable, table 5.7 documents that the following variables affected the predictive accuracy of poll readings: CATI and DCEP. However, the assumptions about their relationship are only in part fulfilled. Although the CATI delivery has a

Table 5.7: House effect across the 2008 Italian General Election polls on Chamber of Deputies: Multivariate Regression model using A' measures for all the parties/coalitions as dependent variables.

The model is computed using formula 3.15, where set of methodologies employed by the polling house and the difference between the two major party/coalitions (referred as DCEP) are the explanatory variables. The A' measures used as dependent variables are computed using the formula 5.1, A.5, A.7, A.6, and A.8. The standard errors for the coefficient are in parentheses and the statistical level of significance follows the rule: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

| | PDL | PD | UDC | SA | Others |
|------------------|-----------------------------|-----------------------------|-----------------------------|----------------------------|----------------------------|
| Random | 0.003 (0.015) | -0.014 (0.012) | — — | — — | 0.017 (0.176) |
| Other Sample | — — | — — | -0.125** (0.060) | -0.045 (0.050) | — — |
| CATI | 0.047** (0.021) | 0.040** (0.017) | 0.054 (0.083) | -0.096 (0.069) | -0.525** (0.243) |
| B: Media | -0.081* (0.048) | -0.047 (0.038) | 0.358* (0.190) | 0.073 (0.158) | 0.477 (0.557) |
| B: Polling House | -0.114** (0.047) | -0.054 (0.038) | 0.378** (0.188) | 0.056 (0.156) | 0.997* (0.550) |
| M: TV | -0.029 (0.027) | -0.019 (0.021) | -0.035 (0.106) | 0.009 (0.088) | 0.553* (0.310) |
| M: Newspaper | 0.011 (0.024) | 0.014 (0.020) | -0.112 (0.097) | 0.030 (0.081) | -0.020 (0.285) |
| M: Internet | 0.022 (0.022) | 0.007 (0.020) | -0.237** (0.098) | -0.167** (0.082) | 0.107 (0.287) |
| DCEP | 0.032*** (0.003) | -0.040*** (0.002) | -0.035*** (0.010) | 0.029*** (0.009) | -0.038 (0.030) |
| Constant | -0.296*** (0.054) | 0.345*** (0.043) | 0.112 (0.212) | 0.749*** (0.177) | -0.561 (0.626) |
| R^2 | 0.758 | 0.836 | 0.354 | 0.249 | 0.253 |
| Adjusted R^2 | 0.733 | 0.819 | 0.286 | 0.170 | 0.176 |
| ANOVA | 0.000 | 0.000 | 0.000 | 0.004 | 0.003 |

significant positive relationship ($\beta = 0.040$ $p < 0.05$), the higher difference between this coalition and the Partito delle Libertà one increases the predictive accuracy of the poll readings ($\beta = -0.040$ $p < 0.01$). However, this is consistent with the evidence provided by table 5.1, where the overall percentages of accuracy values significantly different from 0 for this coalition is the lower in the sample.

Moving to the model where the A' measure for the UDC party is the dependent variable, its predictive accuracy during the 2008 election campaign has been affected by the following variables: Other Sample, Media (as buyer), Polling House, Internet, and DCEP. In contrast with the other models, the use of no-random sampling procedures the predictive accuracy of poll readings for this party ($\beta = -0.125$ $p < 0.05$). According to table 5.7, there is also a significant negative relationship when the medium used to disseminate poll results is the Internet ($\beta = -0.237$ $p < 0.01$) and when the difference estimated between the two main coalitions by poll readings decreases ($\beta = -0.035$ $p < 0.01$). Surprisingly, the predictive accuracy of poll readings for the UDC party decreases when the Polling Houses carry out them on their own initiative ($\beta = 0.378$ $p < 0.10$). The same relationship is documented when the poll has been commissioned by Media actors ($\beta = 0.358$ $p < 0.10$).

Regarding the model where the A' measure for the Sinistra Arcobaleno party is the dependent variable, table 5.7 reports that the following variables affect the predictive accuracy of poll readings: Internet and DCEP. The relationships fulfill our expectations and, therefore, the dissemination of poll results using the Internet increases the predictive accuracy for this party ($\beta = -0.167$ $p < 0.05$) whereas the

higher difference estimated between the two main coalitions increases its inaccuracy ($\beta = 0.029$ $p < 0.01$).

Moving to the model where the A' measure for the small coalition Others is the dependent variable, the evidence provided by table 5.7 does not confirm any of our expectations. Indeed, there is a positive relationship between the TV (as media) variable and the predictive accuracy for this coalition ($\beta = 0.553$ $p < 0.10$). In addition, the significant negative relationship with the CATI delivery system does not fulfill our expectations ($\beta = -0.525$ $p < 0.05$). Surprisingly, the predictive accuracy for the Others coalitions decreases when the polls is carried out on the Polling House's own initiative ($\beta = 0.997$ $p < 0.10$). Moreover, this is the only model where the DCEP variable does not meet the statistical level of significance.

Table 5.8 reports the outcomes of the multivariate regression model applied to A' measures for only three parties/coalitions as dependent variables. As with the previous analysis, we discuss the results for each coalition separately. We start by considering the model where the A' measure for the Centre Right coalition is the dependent variable.

According to table 5.8, the predictive accuracy of poll readings concerning this coalition has been affected by the following variables: CATI, TV, Newspapers, and DCEP. All the evidence fulfills our expectations about the relationships between them and the predictive accuracy of the polls. Indeed, the CATI delivery system and DCEP have a significant positive relationship increasing the inaccuracy of poll readings. Conversely, the dissemination of their results using the Internet and publishing

Table 5.8: House effect across the 2008 Italian General Election polls on Chamber of Deputies: Multivariate Regression model using A' measures for only three parties/coalitions as dependent variables.

The model is computed using formula 3.15, where set of methodologies employed by the polling house and the difference between the two major party/coalitions (referred as DCEP) are the explanatory variables. The A' measures used as dependent variables are computed using the formula 5.3, A.13, and A.14. The standard errors for the coefficient are in parentheses and the statistical level of significance follows the rule: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

| | Centre Right | Centre Left | Others |
|------------------|-----------------------------|-----------------------------|----------------------------|
| Random | 0.014 (0.014) | -0.009 (0.016) | 0.012 (0.174) |
| CATI | 0.082*** (0.019) | -0.009 (0.022) | -0.532** (0.241) |
| B: Media | 0.016 (0.044) | -0.069 (0.051) | 0.457 (0.551) |
| B: Polling House | -0.009 (0.043) | -0.070 (0.050) | 0.974* (0.545) |
| M: TV | -0.043* (0.024) | 0.003 (0.028) | 0.555* (0.307) |
| M: Newspaper | -0.044* (0.022) | 0.046* (0.026) | -0.010 (0.282) |
| M: Internet | -0.023 (0.023) | -0.001 (0.026) | 0.129 (0.285) |
| DCEP | 0.022*** (0.002) | -0.025*** (0.003) | -0.037 (0.030) |
| Constant | -0.385*** (0.049) | 0.475*** (0.057) | -0.586 (0.620) |
| R^2 | 0.653 | 0.556 | 0.253 |
| Adjusted R^2 | 0.617 | 0.510 | 0.175 |
| ANOVA | 0.000 | 0.000 | 0.003 |

in newspapers has a negative relationship decreasing the predictive inaccuracy for the Centre-Right coalition. Concerning the model where the A' measure for the Centre-Left coalition is the dependent variable, table 5.8 reports that newspapers and DCEP variables affect the accuracy of polls for this coalition. However, this evidence does not fulfill our expectations. Indeed, the dissemination of poll results using newspapers increases their predictive inaccuracy ($\beta = 0.046$ $p < 0.10$). This may be evidence of Berlusconi's argument in favour of the centre-left bias in Italian polls during the election campaigns. Moving to the model where the A' measure for the Others coalition is the dependent variable, table 5.8 documents the same evidence reported in table 5.7. Specifically, none of our expectations is supported by the outcomes where the predictive inaccuracy of polls increases when they are carried out on the Polling House's own initiative ($\beta = 0.974$ $p < 0.10$) and their results are disseminated by TV shows ($\beta = 0.55$ $p < 0.10$). Conversely, the use of the CATI delivery system increases the predictive accuracy of poll predictions for the small coalition of Others ($\beta = -0.082$ $p < 0.05$). In the light of these results, we may conclude that the two variables playing an important role in the predictive accuracy of poll readings are the CATI delivery system and the DCEP across all the measures employed as dependent variables. These results are also in line with the evidence provided by the models used for the 2006 Italian General Elections. In contrast to the previous election, tables 5.6, 5.7, and 5.8 report that the predictive accuracy of poll readings has been affected by other variables like the media used to disseminate their results and who commissioned the polls.

5.4 Voter Sentiment Results

Although the previous section confirmed one of two hypotheses on which this thesis has been based, it is not possible to completely rule out that there was a voters sentiment change during the election campaign especially concerning the Partito Democratico and Others coalition. In order to estimate these movements, we will undertake a statistical analysis using two different approaches. Firstly, we will estimate the error in our sample span in both the last six and the last two months of the election campaign to see what evidence they provide concerning the true voters sentiment change and, therefore, the reliability of the poll readings. Secondly, we will employ the autoregressive model (AR(1)) to investigate the true over time voters sentiment change in the 2008 general election using the well-established model proposed by Erikson and Wlezien (1999). Italy has a multi-party system, whereas the procedures in the literature have been developed on the basis of the US, which has a two-party system. In order to estimate the true over time voters sentiment change, we will employ the autoregressive model using the poll readings for each coalition as dependent variables. Doing so, we will be able to estimate the change for each coalition and the degree of those movements.

5.4.1 Analysis of Variance

The accuracy of poll predictions may be comprised by different measures on the basis of their various purposes. In this thesis, specific measures (A , A' , and B_w)

have been already applied to estimate the difference between the poll readings and the election outcomes. The evidence showed a high presence of inaccuracy in Italian polling during the 2008 general elections. Following the main purpose of this thesis estimating the major and, in particular, the strongest cause of inaccuracy we have undertaken an analysis of variance of the poll readings in order to identify their amount of error and voters sentiment change. To do that, we employed the following measures: observed variance, error variance (and sampling error), true variance, and reliability. According to the evidence provided by house effect analysis, the expectation is that the presence of voters sentiment change for the five coalitions - and, in particular, for the Partito Democratico and the Others coalition - is comprised in the true variance and reliability measures; in other words, when the amount of true variance is higher than the error measures.

Table 5.9: 2008 Italian General Election polls on Chamber of Deputies: analysis of variance all sample (October - March)

The analysis of variance is applied to all the parties/coalitions running the electoral race over the six months of the campaign. The Observed Variance (OV) refers to the variance of poll readings. The Error Variance (EV) is the average of error. The Sampling Error (SE) refers to formula 3.16. The True Variance (TV) is the difference between OV and EV. The Reliability is the ratio between TV and OV.

| | PDL | UDC | PD | SA | Others | Centre Right | Centre Left | Sample |
|-------------------|-------|------|-------|------|--------|--------------|-------------|--------|
| Mean | 45.38 | 5.89 | 36.63 | 7.28 | 4.97 | 51.20 | 43.83 | 1168 |
| Observed Variance | 5.45 | 1.59 | 4.83 | 1.80 | 5.93 | 2.69 | 2.87 | — |
| Error Variance | 2.12 | 0.27 | 1.99 | 0.58 | 0.40 | 2.14 | 2.11 | — |
| Sampling Error | 1.46 | 0.52 | 1.41 | 0.76 | 0.64 | 1.45 | 1.45 | — |
| True Variance | 3.33 | 1.32 | 2.84 | 1.23 | 5.52 | 0.55 | 0.77 | — |
| Reliability | 0.61 | 0.83 | 0.59 | 0.68 | 0.93 | 0.20 | 0.27 | — |

Table 5.9 shows the outcomes of those measures covering the whole six months of the 2008 election campaign for each coalition. For the sake of simplicity, we will discuss the outcomes for each coalition separately. According to table 5.9, the polls concerning Popolo delle Libertà have 5.45 as observed variance and error variance of 2.12 (sampling error 1.46). Subtracting the latter from the observed variance, we obtain that the true variance over the six months for the Popolo delle Libertà is 3.33, which means that the variance of those polls is not only due to the sampling procedure employed by the polling houses but also to a certain degree of voters sentiment movement. However, the estimate of statistical reliability (the ratio of true variance and observed variance) is only 0.61, which is lower than expected. In order to estimate whether the inaccuracy in the last two months of the election campaign is also due to voters sentiment change on the basis of house effect and lower procedure outcomes, we will compute the analysis of variance considering only the months of February and March.

Table 5.10: 2008 Italian General Election polls on Chamber of Deputies: analysis of variance in the last two months (February and March).

The analysis of variance is applied to all the parties/coalitions running the electoral race over the last two months of the campaign. The Observed Variance (OV) refers to the variance of poll readings. The Error Variance (EV) is the average of error. The Sampling Error (SE) refers to formula 3.16. The True Variance (TV) is the difference between OV and EV. The Reliability is the ratio between TV and OV.

| | PDL | UDC | PD | SA | Others | Centre Right | Centre Left | Sample |
|-------------------|-------|------|-------|------|--------|--------------|-------------|--------|
| Mean | 44.52 | 6.24 | 36.61 | 7.22 | 5.42 | 50.76 | 43.82 | 1197 |
| Observed Variance | 1.74 | 0.97 | 3.08 | 1.20 | 2.00 | 1.67 | 1.42 | — |
| Error Variance | 2.06 | 0.49 | 1.94 | 0.56 | 0.43 | 2.09 | 2.06 | — |
| Sampling Error | 1.44 | 0.69 | 1.39 | 0.75 | 0.65 | 1.44 | 1.43 | — |
| True Variance | -0.32 | 0.48 | 1.15 | 0.64 | 1.56 | -0.42 | -0.63 | — |
| Reliability | -0.18 | 0.49 | 0.37 | 0.53 | 0.79 | -0.25 | -0.44 | — |

According to table 5.10, we cannot argue that there was a shift in voters sentiments over the last two months of the election campaign concerning the Popolo della Libertà coalition because the true variance and the reliability outcomes are negative. In other words, the error variance and the sampling error are higher than the observed variance. Therefore, the error derives directly from the sampling procedure employed by the polling houses.

Regarding the Partito Democratico coalition, table 5.9 reports a lower observed variance (4.83) compared to Popolo della Libertà (5.45). Moreover, the error variance and its sampling error are 1.99 and 1.41 respectively. In addition, the true variance (2.84) and reliability (0.59) are also lower compared to Popolo della Libertà. According to the evidence provided earlier by house effect analysis, we expect to obtain a higher true variance. Nevertheless, those measures comprise a voters sentiment movement that is lower than expected. Focusing on the last two months, the values obtained for the true variance and reliability are lower than the whole election campaign (see table 5.10). Therefore, we may argue that there is evidence of voters sentiment change over the election campaign both in the long- and short-term with regard to the Partito Democratico. However, table 5.9 reports that the observed variance for UDC poll readings is 0.97. Moreover, the error variance and its sampling error are small: 0.49 and 0.69 respectively. Subtracting the error variance from the observed variance, we obtain 0.48 of true variance, which comprises a small shift in voters sentiment over the six months of the election campaign. According to table 5.10, the true variance in the final months is more than doubled and, there-

fore, the reliability is too. In the light of this, we may argue that any movement in voters sentiment concerning UDC occurred more over the last two months than in the election campaign overall. Moreover, the inaccuracy may be due to those movements rather than to the sampling procedure employed by different polling houses. This is consistent with the evidence provided by the correlation between the house-adjusted poll readings and the number of days between poll readings and Election Days, where there is a high dispersion in the series in the first parts of the election (see figure 5.7(a)).

Regarding the small centre-left coalition Sinistra Arcobaleno, table 5.9 reports 1.80 of observed variance and error variance and its sampling errors are 0.58 and 0.76 respectively. To obtain the true variance, we subtract the error variance from the observed variance. As table 5.9 shows, the true variance and its reliability are 1.23 and 0.68 respectively. Therefore, this evidence shows a small shift in voters sentiment change in this coalition. This is also confirmed in table 5.10, where we computed the two measures for the last two months of the election campaign. According to this, the accuracy of those poll readings is in part affected by the sampling procedure employed by polling houses, both in the long and final run of the election campaign. In addition, this evidence is consistent with the higher presence of the house effect in both poll readings and accuracy values estimated in the previous analysis.

Regarding the Others coalition, table 5.9 reports a high observed variance (5.93) and low error variance (0.40) and sampling error (0.64). According to this, the true variance (5.52) and reliability (0.93) obtained comprise a larger movement in

voters sentiment. In other words, there was a significant shift in voters sentiment over the six months of the election campaign. However, these outcomes are different from those reported in table 5.10 concerning the last two months of the election campaign. Indeed, the Others poll readings have lower observed variance (2) and almost the same error variance (0.43) and sampling error (0.65). Accordingly, the true variance and reliability are 1.56 and 0.79 respectively. With this in mind, we may argue that the poll readings for Others are more affected by voters sentiment change than the sampling error procedure employed by the polling houses both in the long and in the final run of the election campaign.

Regarding the centre-right coalition¹⁴, the observed variance, error variance, and sampling error are 2.69, 2.14, and 1.45 respectively. Accordingly, the true variance is only 0.55, which comprises a small shift of voters sentiment. Moreover, reliability (0.20) is also lower than expected. Table 5.10 reports these measures concerning the last two months of the election campaign. According to the table, we cannot draw any conclusions about true voters sentiment change because the true variance and reliability obtained are negative. In other words, poll readings concerning the centre-right coalition are strongly affected by the sampling procedure employed by different polling houses.

According to table 5.9 the centre-left coalition¹⁵ presents the same pattern as the centre-right coalition. Specifically, we obtained high error variance (2.11) and sampling error (1.45). Subtracting the error variance from the observed variance (2.87),

¹⁴This is obtained by adding the Popolo della Libertà and UDC poll readings.

¹⁵This is obtained by adding Partito Democratico and Sinistra Arcobaleno poll readings.

the true variance and the reliability comprise a small movement in voters sentiment. Moreover, table 5.10 covering the last two months of the election campaign shows negative values concerning the true variance and reliability. Therefore, we may argue that any movement in voters sentiment concerning the centre-left coalition occurred over long-term rather than in the final stages of the election campaign.

5.4.2 AR(1) Results

The previous analysis of variance of poll readings for each coalition provided evidence of the presence of a small movement in voters sentiment, except for the group of small parties not aligned with any coalition (Others). Specifically, in all the major coalitions the voters sentiment change occurred throughout the entire election campaign rather than in the last two months. This is in line with the literature concerning movement in voters sentiment. In other words, over the last months of election campaign there is less movement in voters sentiment.

In order to estimate properly the degree of those movements, we apply an autoregressive model (AR(1)) following the approach proposed by Erikson and Wlezien (1999). Recalling the model, it assumes that the true voters sentiment on a given day to be explained as a function of voters sentiment on previous days and shocks from the election campaign. Specifically, the variance of daily shocks and their persistence will comprise the real movement when it occurs. Assuming that poll readings is a stationary series, the autoregressive parameter value will be between 0 and 1 and it will geometrically decay as the number of days between poll readings

increases.

Table 5.11: 2008 Italian General Election: true voters sentiment change using AR(1) for Popolo delle Libertà.

In the column called ‘Correlation’, the values refer to the coefficient using the AR(1) - formula 3.34 - with different lag of days. In the column called ‘True Correlation’, Heise’s procedure (1969) is applied by multiplying the observed correlation to reliability (last row of table 4.5). The statistical level of significance follows the rules: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

| | Correlation (γ) | True Correlation ($\gamma * rel$) | R^2 | RMSE |
|-------|--------------------------|-------------------------------------|-------|------|
| Lag 1 | 0.392*** | 0.239 | 0.14 | 2.24 |
| Lag 2 | 0.217* | 0.132 | 0.23 | 2.15 |
| Lag 3 | 0.339** | 0.207 | 0.15 | 2.30 |
| Lag 4 | 0.349** | 0.213 | 0.12 | 2.36 |
| Lag 5 | 0.311** | 0.190 | 0.14 | 2.37 |
| Lag 6 | 0.318** | 0.194 | 0.13 | 2.42 |
| Lag 7 | 0.377** | 0.230 | 0.13 | 2.47 |

As with the previous analysis, we will discuss the outcome of AR(1) for each coalition separately. Table 5.11 presents the outcomes obtained when applying the AR(1) model to the poll readings for the Popolo delle Libertà coalition. The first column gives the observed correlation between poll readings and their lagged values over 1 to 7 days. The main expectation is that we will see a geometrical decay of values of parameter (γ), which comprises the movement in voters sentiment as the number between poll readings increases. However, the evidence provided by table 5.11 shows the following pattern: 0.392, 0.217, 0.339, 0.349, 0.321, 0.318, and 0.377. Although it is not a stable increasing trend, these outcomes are not consistent with the expectation concerning the AR(1) model. However, the analysis of variance presented earlier confirmed these outcomes. Specifically, the values of the parameter

satisfy the condition of being between 0 and 1 but they do not geometrically decay as the number of days between poll readings increases. After an initial decreasing trend over the first two lags, the values of the parameter rise as the number of days increases, decreasing again using a lag of 5 days and then, rising up finally using the two bigger lags. Despite the oscillating trend, all the parameters meet the statistical level of significance. Therefore, we may argue that the accuracy of poll readings for the Popolo delle Libertà have been influenced by the poll readings in the long term. However, this is evidence of an integrated rather than a stationary process given the oscillating trend. Now, we take into account the statistical reliability of the polls in order to estimate the degree of voters sentiment change - the true over time correlation - excluding the amount of error that would result from random sampling. To do that, we multiply the values of the parameter by the statistical reliability for the six months of the election campaign (0.61). The second column of table 5.11 reports the outcomes of true over time correlation, but the pattern of values of the parameter does not change so much.

Regarding Partito Democratico, table 5.12 reports the outcomes when applying the AR(1) model. According to the previous analysis, the main expectation is to estimate a small shift in voters sentiment both in the long run and in the final stages of the election campaign. Therefore, we expect that both of the AR(1) conditions to be satisfied. However, table 5.12 reports that the values of parameter are negative and none of them meet the statistical levels of significance. In addition, only using a bigger lag of days is the condition of geometrical decay of values of the

Table 5.12: 2008 Italian General Election: true voters sentiment change using AR(1) for Partito Democratico.

In the column called ‘Correlation’, the values refer to the coefficient using the AR(1) - formula 3.34 - with different lag of days. In the column called ‘True Correlation’, Heise’s procedure (1969) is applied by multiplying the observed correlation to reliability (last row of table 4.5). The statistical level of significance follows the rules: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

| | Correlation (γ) | True Correlation ($\gamma * rel$) | R^2 | RMSE |
|-------|--------------------------|-------------------------------------|-------|------|
| Lag 1 | -0.089 | -0.053 | 0.04 | 2.22 |
| Lag 2 | -0.141 | -0.083 | 0.03 | 2.26 |
| Lag 3 | -0.114 | -0.067 | 0.01 | 2.35 |
| Lag 4 | -0.117 | -0.069 | 0.01 | 2.41 |
| Lag 5 | -0.108 | -0.064 | 0.01 | 2.45 |
| Lag 6 | -0.105 | -0.062 | 0.06 | 2.43 |
| Lag 7 | -0.089 | -0.053 | 0.02 | 2.53 |

parameter satisfied. In other words, without taking into consideration the level of significance, the voters sentiment change concerning the Partito Democratico follows a stationary process only in the long run of the election campaign. Using the Heise procedure to exclude the error among the series, the values of the parameter follow the same pattern. All these outcomes are consistent with the evidence provided by the accuracy measures. Recalling the main conclusion, the overall performance of inaccuracy was only 22% in poll readings and in the last two months of the election campaign almost all polls were accurate. In the light also of the house effect evidence, we may argue that the inaccuracy of polls concerning Partito Democratico is due to both the house effect and voters sentiment change in the long run of the election campaign. Accordingly, in the last two months the inaccuracy is mainly due to the house effect, which is almost absent.

Table 5.13: 2008 Italian General Election: true voters sentiment change using AR(1) for UDC.

In the column called ‘Correlation’, the values refer to the coefficient using the AR(1) - formula 3.34 - with different lag of days. In the column called ‘True Correlation’, Heise’s procedure (1969) is applied by multiplying the observed correlation to reliability (last row of table 4.5). The statistical level of significance follows the rules: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

| | Correlation (γ) | True Correlation ($\gamma * rel$) | R^2 | RMSE |
|-------|--------------------------|-------------------------------------|-------|------|
| Lag 1 | 0.093 | 0.077 | 0.10 | 1.29 |
| Lag 2 | 0.048 | 0.040 | 0.10 | 1.25 |
| Lag 3 | 0.222* | 0.184 | 0.10 | 1.28 |
| Lag 4 | 0.235* | 0.195 | 0.06 | 1.30 |
| Lag 5 | 0.238* | 0.198 | 0.06 | 1.32 |
| Lag 6 | 0.233* | 0.193 | 0.06 | 1.34 |
| Lag 7 | 0.253* | 0.210 | 0.07 | 1.36 |

Table 5.13 reports the outcomes of the AR(1) model concerning the UDC. In contrast to the previous coalitions, we expect that the small movement in voters sentiment occurs mainly in the final run of the election campaign. However, table 5.13 shows that the values of the parameter increase as the number of days between polls increases. In addition, the parameters of the first two lags do not meet statistical levels of significance. However, the pattern followed by those values is fairly stable with a slightly oscillating trend between the lag 4, 5, and 6 days. Nevertheless, the condition of stationary is not satisfied because when the number of days between polls increase, the values of the parameter do not decay. This is also confirmed when applying the Heise procedure in order to estimate the true over time correlation taking into account statistical reliability. Specifically, the values of the parameter are less than 1 but they do not decay. Therefore, the voters sentiment

change occurred more in the long run rather than in the final stages of the election campaign. Accordingly, we may argue that the polls concerning the UDC do not follow a stationary process but there is not evidence of a random walk process. With this in mind, this evidence is not consistent with the main expectations.

Table 5.14: 2008 Italian General Election: true voters sentiment change using AR(1) for Sinistra Arcobaleno.

In the column called 'Correlation', the values refer to the coefficient using the AR(1) - formula 3.34 - with different lag of days. In the column called 'True Correlation', Heise's procedure (1969) is applied by multiplying the observed correlation to reliability (last row of table 4.5). The statistical level of significance follows the rules: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

| | Correlation (γ) | True Correlation ($\gamma * rel$) | R^2 | RMSE |
|-------|--------------------------|-------------------------------------|-------|------|
| Lag 1 | 0.011 | 0.007 | 0.08 | 1.33 |
| Lag 2 | 0.068 | 0.046 | 0.06 | 1.36 |
| Lag 3 | -0.010 | -0.007 | 0.09 | 1.38 |
| Lag 4 | 0.085 | 0.058 | 0.01 | 1.48 |
| Lag 5 | 0.091 | 0.062 | 0.01 | 1.51 |
| Lag 6 | 0.103 | 0.070 | 0.03 | 1.52 |
| Lag 7 | 0.116 | 0.079 | 0.02 | 1.52 |

Regarding the Sinistra Arcobaleno coalition, table 5.14 shows the outcomes of the AR(1) model. According to the previous analysis, the main expectation is a small change in voters sentiments throughout the entire election campaign. As table 5.14 reports, the values of the parameter follow an oscillating trend. In addition, the third value is negative, which is in contrast with one of the conditions of the stationary process. However, none of those values meet the statistical levels of significance. Applying the Heise procedure, the pattern of values of the parameter does not change much. Therefore, we may argue that the high inaccuracy estimated

for this small centre-left coalition is certainly due to the house effect and the voters sentiment change was so small as to have only an insignificant effect on the poor performance of the polls.

Table 5.15: 2008 Italian General Election: true voters sentiment change using AR(1) for Others.

In the column called ‘Correlation’, the values refer to the coefficient using the AR(1) - formula 3.34 - with different lag of days. In the column called ‘True Correlation’, Heise’s procedure (1969) is applied by multiplying the observed correlation to reliability (last row of table 4.5). The statistical level of significance follows the rules: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

| | Correlation (γ) | True Correlation ($\gamma * rel$) | R^2 | RMSE |
|-------|--------------------------|-------------------------------------|-------|------|
| Lag 1 | -0.002 | -0.002 | 0.02 | 2.49 |
| Lag 2 | 0.020 | 0.019 | 0.01 | 2.54 |
| Lag 3 | 0.048 | 0.045 | 0.02 | 2.61 |
| Lag 4 | 0.019 | 0.018 | 0.01 | 2.71 |
| Lag 5 | 0.019 | 0.018 | 0.02 | 2.73 |
| Lag 6 | 0.046 | 0.043 | 0.03 | 2.75 |
| Lag 7 | 0.025 | 0.023 | 0.03 | 2.83 |

Table 5.15 reports the outcomes of the AR(1) model applied to the group of small parties not aligned with any coalition (Others). According to the previous analysis, we expect a significant change in voters sentiment both in the long run and final stages of the election campaign. However, none of the values of parameter meet the statistical levels of significance (table 5.15). Moreover, they do not follow a geometrical decay as the number of days between poll readings decreases. Now, we apply the Heise procedure in order to take into account the statistical reliability excluding the error that would result from random sampling. However, the true over time correlations follow the same pattern of observed correlation. Therefore,

we may argue that the inaccuracy of poll readings concerning the Others are more due to the house effect than to any movement in voters sentiment.

Table 5.16: 2008 Italian General Election: true voters sentiment change using AR(1) for Centre Right.

In the column called ‘Correlation’, the values refer to the coefficient using the AR(1) - formula 3.34 - with different lag of days. In the column called ‘True Correlation’, Heise’s procedure (1969) is applied by multiplying the observed correlation to reliability (last row of table 4.5). The statistical level of significance follows the rules: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

| | Correlation (γ) | True Correlation ($\gamma * rel$) | R^2 | RMSE |
|-------|--------------------------|-------------------------------------|-------|------|
| Lag 1 | -0.125 | -0.025 | 0.03 | 1.60 |
| Lag 2 | 0.083 | 0.017 | 0.06 | 1.60 |
| Lag 3 | 0.144 | 0.029 | 0.07 | 1.62 |
| Lag 4 | 0.163 | 0.033 | 0.03 | 1.61 |
| Lag 5 | 0.138 | 0.028 | 0.04 | 1.66 |
| Lag 6 | 0.155 | 0.031 | 0.02 | 1.66 |
| Lag 7 | 0.163 | 0.033 | 0.03 | 1.69 |

Regarding the centre right coalition, table 5.16 reports the results of applying the AR(1) model. In the light of the previous analysis, the main expectation is a small shift in voters sentiment in the long run election campaign, due to the negative true variance and reliability estimated in the last two months (see table 5.10). According to table 5.16, the values of the parameter do not geometrically decay as the number of days between polls increases. Therefore, we argue that the inaccuracy of polls concerning this coalition is more due to the house effect because any movement in voters sentiment does not follow a stationary process and the values of the parameter do not meet the statistical levels of significance. In addition, applying the Heise procedure, this pattern does not change.

Table 5.17: 2008 Italian General Election: true voters sentiment change using AR(1) for Centre Left.

In the column called ‘Correlation’, the values refer to the coefficient using the AR(1) - formula 3.34 - with different lag of days. In the column called ‘True Correlation’, Heise’s procedure (1969) is applied by multiplying the observed correlation to reliability (last row of table 4.5). The statistical level of significance follows the rules: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

| | Correlation (γ) | True Correlation ($\gamma * rel$) | R^2 | RMSE |
|-------|--------------------------|-------------------------------------|-------|------|
| Lag 1 | 0.106 | 0.029 | 0.01 | 1.75 |
| Lag 2 | 0.104 | 0.028 | 0.02 | 1.78 |
| Lag 3 | 0.096 | 0.026 | 0.02 | 1.83 |
| Lag 4 | 0.100 | 0.027 | 0.02 | 1.88 |
| Lag 5 | 0.114 | 0.031 | 0.01 | 1.92 |
| Lag 6 | 0.136 | 0.037 | 0.09 | 1.88 |
| Lag 7 | 0.101 | 0.027 | 0.02 | 1.98 |

Regarding the centre left coalition, table 5.17 reports the results in applying the AR(1) model and the Heise procedure. On the basis of previous analysis, the main expectation is that there is only a small shift in voters sentiment throughout the whole election campaign. According to table 5.17, none of the values of the parameter meet the statistical levels of significance. Moreover, the values for the first three lags present a geometrical decay (0.106, 0.104, and 0.096) and, then, the values rise showing evidence of an integrated process (random walk with drift). Applying the Heise procedure, the true over time correlations follow the same pattern. In other words, the final run of the election campaign follows a stationary process but when increasing the lag the values of the parameter rise and do not follow a stable trend. Therefore, we may argue that the inaccuracy of the poll readings concerning the centre left coalition are caused more by the house effect and the error in the

series than by a significant movement in voters sentiment.

5.5 Conclusion

Was the 2008 Italian polling more accurate than in 2006? According to what emerged in the previous analysis, the answer to this question is not easy. Despite the overall better performance in terms of accuracy in the 2008 poll readings, there was still a high percentage of polls classified as inaccurate among the coalitions. Specifically, there was a slight decrease in the percentage of inaccurate polls, except for the case of the Partito Democratico¹⁶, where the percentage drops from 91% to 22% of polls classified as inaccurate. However, the most interesting outcomes concern the performance of centre- right and -left coalitions. Theoretically, adding the poll readings of two or more parties/coalitions, the amount of error should decrease providing better predictions. Instead, adding together the poll readings of coalitions on the basis of their centre-right or -left orientations, the outcomes provide evidence of a poorer performance in terms of accuracy, especially for the centre-right coalitions.

According to this, we applied the OLS regression and the lowess procedure to poll readings and accuracy values in order to estimate the degree of the house effect and random error in them. The evidence provided in tables 5.4 and 5.5 confirmed that there was a strong impact of the house effect especially using the poll readings as dependent variables in all the models proposed. However, the outcomes

¹⁶In the previous election, it was named Unione.

concerning the accuracy as dependent variables showed that the house effect has a lower impact over this election campaign. This is consistent with the evidence of overall better performance in terms of accuracy. Moreover, the evidence concerning the lowess procedure for each coalition estimated a low degree of random error in the series that could suggest voters sentiment change, especially over the first part of the election campaign. Using the multivariate regression model to estimate the impact of methodologies employed by polling houses on the predictive accuracy of polls, we can draw at least three main conclusions. Firstly, the results confirm that the CATI delivery system and the DCEP plays an important role without regard to the accuracy measures employed as for the 2006 Italian General elections. Secondly, the predictive accuracy of poll readings has been affected by other variables like the media used to disseminate the results or who commissioned the polls (see tables 5.6, 5.7, and 5.8). Thirdly, the use of a random sampling procedure does not increase the accuracy of poll readings. However, this is also consistent with their overall better performance compared to the previous election. To estimate the degree of voters sentiment change, we employed two different analyses: the variance and autoregressive models. Despite the low presence of error variance due to the sampling procedure especially in the last two months of the election campaign, the autoregressive model provides evidence that the voters sentiment change was so small as to have an insignificant effect on the poll readings especially in the final stages of the election campaign¹⁷. With this in mind, the performance of polls in

¹⁷Moreover, only the values of the parameter of Popolo della Libertà meet the statistical levels of significance allowing us to draw substantial and reliable inferences.

terms of accuracy in the 2008 general election is more influenced by the house effect than any movement in voters sentiment over the election campaign.

Chapter 6

2013 Italian General Election

6.1 Introduction

The 2013 Italian general election was characterized by the presence of six coalitions and a very small coalition of unaligned parties. The actual results of the elections were: 29.55% for Italia Bene Comune, 29.18% for Popolo della Libertà, 10.5% for Coalizione di Centro, 25.55% Movimento 5 Stelle, 2.2% for Rivoluzione Civile, 1.1% for Fare per Fermare il Declino and 1.92% for others parties. The election results actually did not give a real victory to any coalition. However, there were three ‘false’ winners: Popolo della Libertà, Italia Bene comune, and Movimento 5 Stelle.

This chapter is devoted to providing evidence concerning the accuracy and the causes of inaccuracy of all polls that were published during the 2013 Italian general election campaign and asked respondents about their voting intentions for the

Chamber of Deputies.

We analyzed the polls published on the official website between 9 August and 8 February 2013¹.

With this in mind, the remainder of this chapter is structured as follows. The next section will be devoted to presenting the analysis of accuracy using the A , A' , and B_w measures and the discussion of the evidence provided by their outcomes. In the third section, we will present the house effect analysis in order to estimate how much of the variance of poll readings is affected by the methodologies employed by different polling houses. To do that, we will first apply a well-established econometric method (OLS) and the lowess procedure (Cleveland 1979), following the approach proposed by Erikson and Wlezien (1999). Then, we employ a multivariate regression model to estimate the extent of the house effect caused by the methodologies employed by polling houses using the accuracy indexes as dependent variables. In the fourth section, we will employ two different analyses in order to estimate the voters sentiment change for each coalition over the election campaign. Specifically, we will undertake a traditional analysis of variance, using measures like sampling error and reliability, to estimate the error in the poll readings. Then, we will employ a more sophisticated analysis using an autoregressive model (AR(1)) in order to estimate whether the error is due to sampling procedures or voters sentiment change. Finally, in section five, we will draw the main conclusions on the basis of the evidence provided by all the analysis undertaken.

¹That means 182 days before Election Day, which covers the election campaign. On the basis of Italian law, polls cannot be published during the 15 days before Election Day.

6.2 Accuracy Results

Recalling formula 3.1 used to measure the accuracy of polls in the 2013 Italian national election, we applied the formula to all six coalitions treating each of them as a party and those small unaligned parties (“Others”) as seventh-party candidates. Therefore, we rewrite equation 3.1 as follows:

$$A'_{pdl} = \ln \left[\frac{(pdl/(pd + m5s + cdm + rc + ffd + o))}{(PDL/(PD + M5S + CDM + RC + FFD + O))} \right] \quad (6.1)$$

where *pdl* is the Popolo delle Libertà poll prediction, *pd* is the Italia Bene Comune² poll prediction, *m5s* is Movimento 5 Stelle poll prediction, *cdm* is Coalizione di Centro, *rc* is Rivoluzione Civile poll prediction, *ffd* is Fare per Fermare il Declino poll prediction and *o* is Others poll prediction. Conversely, *PDL* is the actual result obtained by the Popolo delle Libertà, *PD* is the actual results for the Italia Bene Comune, *M5S* is the actual vote for Movimento 5 Stelle, *CDM* is the actual results for Coalizione di Centro, *RC* is the actual results for Rivoluzione Civile, *FFD* is the actual vote for Fare per Fermare il Declino and *O* is the actual results achieved by the others. We do the same for the other six parties³. As for the other two elections, if the value of *A'* is positive, the poll overestimates support for the party. Conversely, if the value is negative, the poll underestimates support. To measure the extent to which under- and overestimates are significant as opposed to falling

²The centre left coalition is mainly composed by the Partito Democratico (PD) and other small parties of centre left. For the sake of simplicity, the Italia Bene Comune will be referred to as Partito Democratico and/or PD in order to be easily compared with the two previous elections.

³Please refer to Appendix for the full list of *A'* measures.

within the margins of what can be expected due to sampling error, we calculate the standard error of A' using a 95% confidence interval. Therefore, polls given values of A' falling outside the confidence interval we regard as inaccurate, those given values within it as accurate. Recalling equation 6.1, we rewrite equation 3.2 as follows:

$$Variance(A'_{pdl}) = 1/(n \cdot pdl \cdot (pd + m5s + cdm + rc + ffd + o)) \quad (6.2)$$

We do the same for the other parties⁴. To compare the results with the other two elections, we apply the formula 3.1 to the Partito Democratico, Popolo della Libertà, treating each coalition as a party and the Movimento 5 Stelle as third-party candidates⁵:

$$A'_{coal13} = \ln \left[\frac{(pdl/(pd + m5s))}{(PDL/(PD + M5S))} \right] \quad (6.3)$$

$$Variance(A'_{coal13}) = 1/(n \cdot pdl \cdot (pd + m5s)) \quad (6.4)$$

In addition, we will employ the original formula in order to compare the outcomes with those of the other two general elections. Following Martin, Traugott, and Kennedy's measure, Popolo della Libertà and Partito Democratico coalitions will be treated as parties⁶.

To estimate the overall error for each poll reading, we employ the measure (B)

⁴Please refer to Appendix for the full list of variance of A' measures.

⁵Please refer to Appendix for the full list of A' measures.

⁶Please refer to the Appendix for the measure.

proposed by Arzheimer and Evans (2014) which takes into account all the parties/coalitions running the elections race at the same time and which corrects for the dependency of A' on the reference party (see formula 3.5). Given the presence of small unaligned parties in the Italian political system, we apply the weighted version of this measure: B_w .

Following the literature on election studies (Gelman and King 1993; Erikson and Wlezien 1999; Jennings and Wlezien 2015), we expect the polls in 2013 to have been accurate closer to Election Day. To estimate this assumption, we will check the timing of accuracy/inaccuracy on the basis of the evidence provided by the A , A' , and B_w measures. Specifically, we compare the monthly averages of all measures and the monthly percentages of the polls classified as inaccurate by A and A' and the monthly percentages of polls statistically biased by the χ^2 for the B_w measures using the threshold of $p \leq 0.05$.

6.2.1 Findings

Were the Italian pollsters less accurate in 2013 than in the previous two elections? To answer this question we have undertaken an empirical analysis of the accuracy of those polls published during the six months prior to Election Day. The analysis only covers polls concerning voting intentions for the Chamber of Deputies election and excluding those for the Senate⁷. In addition, we also include in the analysis those where the pollster did not specify which of the two branches of Parliament was being

⁷Given the difference in the electoral system for the two Chambers of the Italian Parliament, we prefer to exclude from the analysis those polls referring to the Senate.

referred to. On this basis there were 158 polls for the Chamber of Deputies.

Figure 6.1: 2013 Italian General Election polls for the six parties/coalitions over six months of election campaign

y-axis = percentage support according to poll readings. x-axis = dates n which poll readings were taken.

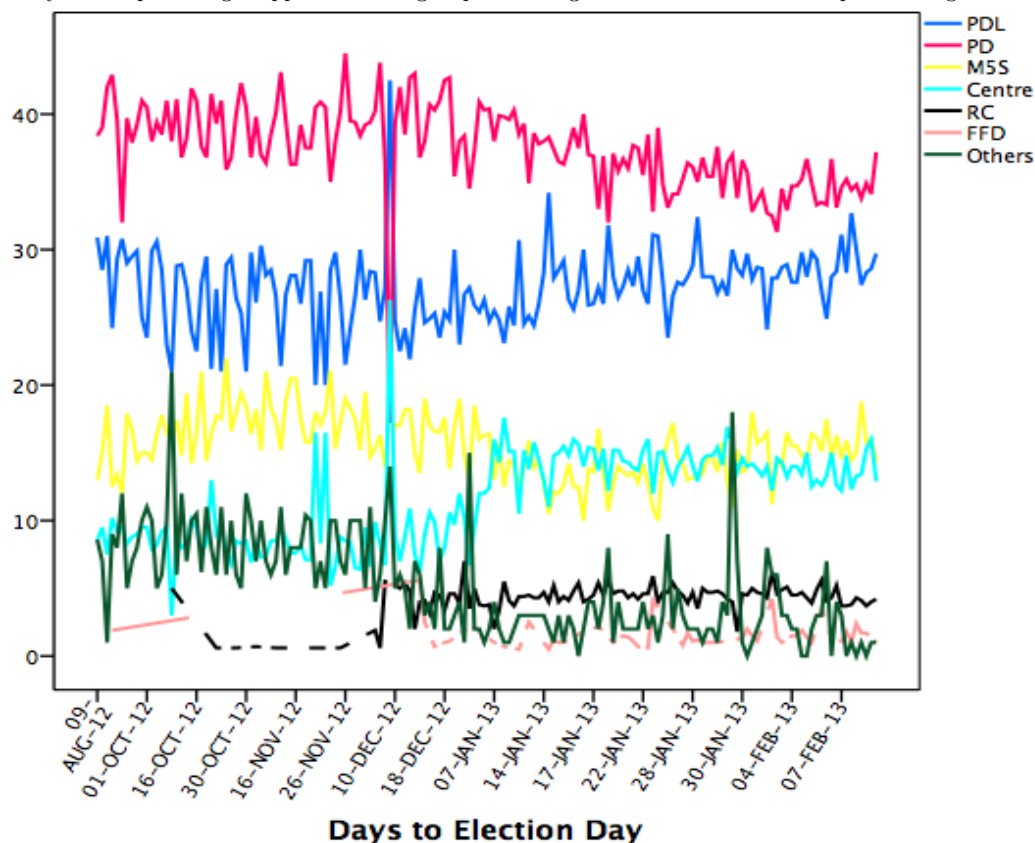


Figure 6.1 shows the poll readings for each coalition over the election campaign. According to this, the centre-left was leading the race especially over the first four months of the campaign and, after the Christmas break, its share in poll readings steadily decreases closer to Election Day. In contrast, the share estimated for the centre-right coalition, Popolo delle Libertà, presents an oscillating trend which is steady between 25% and 35% with a slight increase in the last month of the election campaign. Of the other coalitions, only the share for the Centre coalition in support of incumbent Prime Minister, Mario Monti, presents an increasing trend across time.

Concerning the anti-system coalition, the Movimento 5 Stelle presents an oscillating and decreasing trend.

Table 6.1: 2013 Italian General Election polls on Chamber of Deputies: comparison of percentage of inaccuracy applying A , A' , B and B_w

The percentages for the A and A' measures refer to their values falling outside the 95% confidence interval. The A measure is computed considering only two coalitions (PDL and PD) using the formula 3.1. The A' measures is computed using all the coalitions competing the election (formula 6.1, A.17,A.18, A.19, A.20, A.21, and A.22). The percentages for the B_w measure refer to proportion of their values that are statistically biased on the basis of the χ^2 test using $p \leq 0.05$ threshold. The B_w measure is computed using the formula 3.5.

| | Polls | PDL | PD | M5S | Centre | RC | FFD | Others |
|-------------------|-------|-----|------|-----|--------|-----|-----|--------|
| A | 82% | — | — | — | — | — | — | — |
| A' (3 parties) | — | 88% | 100% | 59% | — | — | — | — |
| A' (7 parties) | — | 70% | 100% | 95% | 83% | 96% | 28% | 75% |
| B_w (3 parties) | 100% | — | — | — | — | — | — | — |
| B_w (7 parties) | 100% | — | — | — | — | — | — | — |
| N | 158 | 158 | 158 | 158 | 158 | 94 | 69 | 158 |

As explained earlier, we revised the A measure in two versions in order to allow us to compare the extent of inaccuracy in the last three Italian general elections. Doing so, we are also able to estimate whether there is a rising or decreasing trend in terms of the extent of inaccuracy in Italian polling during the elections. Therefore, table 6.1 compares the percentages of polls classified as inaccurate where the first row reports the outcomes using the measure of A ; the second row reports the outcomes using the measure of A' applied to three coalitions (Popolo della Libertà, Partito Democratico, and Movimento 5 Stelle); the third row reports the outcomes of measure of A' applied to all coalitions; and the last two rows document the total percentage of polls that

are statistically biased using the χ^2 test with the threshold of $p \leq 0.05$ for the B_w measure computed using three and seven parties/coalitions respectively. For the sake of simplicity, we will discuss the results for each measure separately. Focusing on the first row where the measure of A (formula 3.1) is applied, overall 82% of polls are classified as inaccurate, which show a high percentage of inaccuracy in polls. Compared with the two previous elections, the percentage of polls classified as inaccurate rises from 22% to 82%. The story does not change so much when using the two versions of the A' measure. Specifically, when computing only three parties/coalitions, the performance of polls for the centre left is so high reaching 100%. However, surprisingly, the performance of polls for the anti-system movement (M5S) is lower than the two main centre- right and -left coalitions, which also shows a higher percentage of inaccuracy compared with the previous two elections. Applying the A' measure to all the coalitions, table 6.1 reports only a low percentage of polls classified as inaccurate for the small party of Fare per Fermare il Declino (28%) where the average among the rest is higher than 80%. Focusing on the B_w measure, the percentages of statistically biased polls using the χ^2 reaches 100% without regard to the number of parties/coalitions employed in the computation process. These percentages are higher than those provided by the other measures and they reveal a significant presence of error estimated. Compared to the previous election, these percentages rise from 76% (2006) and 65% (2008) to 100%. This is also consistent with the results from the A and A' measures.

Table 6.2: 2013 Italian General Election polls on Chamber of Deputies: monthly average and percentage of inaccuracy of A , A' , and B_w using all the coalitions.

The percentages for the A and A' measures refer to their values falling outside the 95% confidence interval. The A measure is computed considering only two parties/coalitions (PDL and PD) using the formula 3.1. The A' measures is computed using all the coalitions competing the election (formula 6.1, A.17, A.18, A.19, A.20, A.21, and A.22). The percentages for the B_w measure refer to proportion of their values that are statistically biased on the basis of the χ^2 test using $p \leq 0.05$ threshold. The B_w measure is computed using the formula 3.5.

* the values of A' over the given month are both positive and negative.

| | Polls | | PDL | | PD | | M5S | | Centre | | RC | | FFD | | Others | |
|------------------------|---------|--------------|--------|-------|--------|--------|-------|-------|--------|------|------|------|------|------|--------|------|
| | A | B_w | A' | A' | A' | A' | A' | A' | A' | A' | A' | A' | A' | A' | A' | A' |
| 9 Aug - 9 Sept | average | -0.256 0.463 | -0.023 | 0.642 | -0.857 | -0.325 | — | — | — | — | — | — | — | — | 0.717* | |
| | % | 100 100 | 0 | 100 | 100 | 67 | — | — | — | — | — | — | — | — | 100 | |
| 10 Sept - 9 Oct | average | -0.352 0.479 | -0.192 | 0.622 | -0.844 | -0.318 | — | — | — | — | — | — | — | — | 1.566 | |
| | % | 93 100 | 43 | 100 | 100 | 50 | — | — | — | — | — | — | — | — | 100 | |
| 10 Oct - 9 Nov | average | -0.377 0.441 | -0.248 | 0.607 | -0.645 | -0.308 | — | — | — | — | — | — | — | — | 1.528 | |
| | % | 100 100 | 58 | 100 | 100 | 84 | — | — | — | — | — | — | — | — | 100 | |
| 10 Nov - 9 Dic | average | -0.399 0.519 | -0.266 | 0.600 | -0.677 | -0.264 | — | — | — | — | — | — | — | — | 1.488 | |
| | % | 100 100 | 70 | 100 | 100 | 96 | — | — | — | — | — | — | — | — | 100 | |
| 10 Dic - 9 Jan | average | -0.434 0.416 | 0.168 | 0.705 | -0.311 | 0.091* | 0.658 | 0.193 | 0.476* | | | | | | | |
| | % | 96 100 | 38 | 100 | 77 | 50 | 92 | 15 | 60 | | | | | | | |
| 10 Jan - 9 Feb | average | -0.226 0.382 | 0.288 | 0.623 | -0.443 | 0.449 | 0.753 | 0.227 | 0.007* | | | | | | | |
| | % | 61 100 | 92 | 100 | 99 | 97 | 99 | 17 | 58 | | | | | | | |

Looking in more depth at these percentages of poll inaccuracy, tables 6.2 and 6.3 compare the monthly averages and percentages of values of the A and A' measures applied to all and three coalitions respectively. In the second column, table 5.2 reports the monthly averages and the percentages of polls that are statistically biased using the χ^2 test for the B_w measure. For the sake of simplicity, we will discuss firstly the evidence provided by table 6.2 and, then, that in table 6.3 for each coalition separately.

According to table 6.2, when the A measure is applied, there is an underestimation in Italian polling for the main centre-right coalition. The monthly averages show negative values significantly different from 0, especially over the central part of the election campaign. In other words, the monthly percentage of polls classified as inaccurate reaches 100% in the first part of the election campaign and slightly decreases over the last two months. Moving to the results concerning the B_w measure, table 6.2 reports a fairly stable monthly average across the campaign. Specifically, there is a slight increasing trend over the first four months of the election campaign followed by a decrease of estimated error in the last two months. The monthly percentages of statistically biased polls using the χ^2 stand steadily at 100%. Regarding the main centre-right coalition (Popolo della Libertà), table 6.2 reports interesting patterns. Specifically, over the first four months of the election campaign the monthly average of A' values is negative showing a constant underestimation. However, table 6.2 also reports that in the final two months there was an overestimation concerning the Popolo della Libertà shown in the values of A' , there being

positive and significantly different from 0. Focusing on the main centre-left coalition Partito Democratico, table 6.2 reports a constant overestimation with positive values significantly different from 0. Specifically, the monthly percentages of polls classified as inaccurate reaches 100% over the entire election campaign. Regarding the anti-system movement, Movimento 5 Stelle has been constantly underestimated over the election campaign showing a monthly negative average of A' values (see table 6.2). In addition, the percentage of polls classified as inaccurate is very high reaching 100% in the first fourth months of the election campaign and then slightly decreasing in the final two months. Concerning the centre coalition supporting the incumbent Prime Minister, Mario Monti, table 6.2 reports a similar pattern to the Popolo della Libertà. According to the table, the monthly averages between August and early December are negative revealing an underestimation for this coalition. However, in the last part of the election campaign the average of A' is positive. In other words, the poll readings overestimated the electoral performance of this coalition. What is also interesting is that the percentage of polls classified as inaccurate increases closer to Election Day. In other words, in the second part of the election campaign (between November and February) the ability of polls to predict the electoral results is lower than in the previous months. Moving to the small party of Rivoluzione Civile, table 6.2 reports a high percentage of polls classified as inaccurate. It must be noted that this coalition entered the race only two months before Election Day and for this reason there are polls reading featuring it only in the last part of the election campaign. However, table 6.2 reports that the monthly

average of A' is positive and significantly different from 0. Regarding the party of Fare per Fermare il Declino, table 6.2 reports that the timing of inaccuracy in the poll readings decreases as the number of days between the time the poll was carried out and the Election Day decreases. In other words, from 100% of polls classified as inaccurate between September and October, the percentage that are inaccurate decreases to 17% of polls published in the last month of election campaign. Indeed, the overall percentage of polls classified as inaccurate is 28% as reported in table 6.1. Regarding the group of small parties not aligned with any coalition (Others), table 6.2 reports a constant overestimation of this small coalition. Specifically, the monthly average of A' values is positive and significantly different from 0 especially in the first part of the election campaign. Indeed, during the first and the last month there are both positive and negative A' values. In addition, the percentage of polls classified as inaccurate is stable at 100% in the first four months of the election campaign, but in the last two months it is almost half that (60% and 58%).

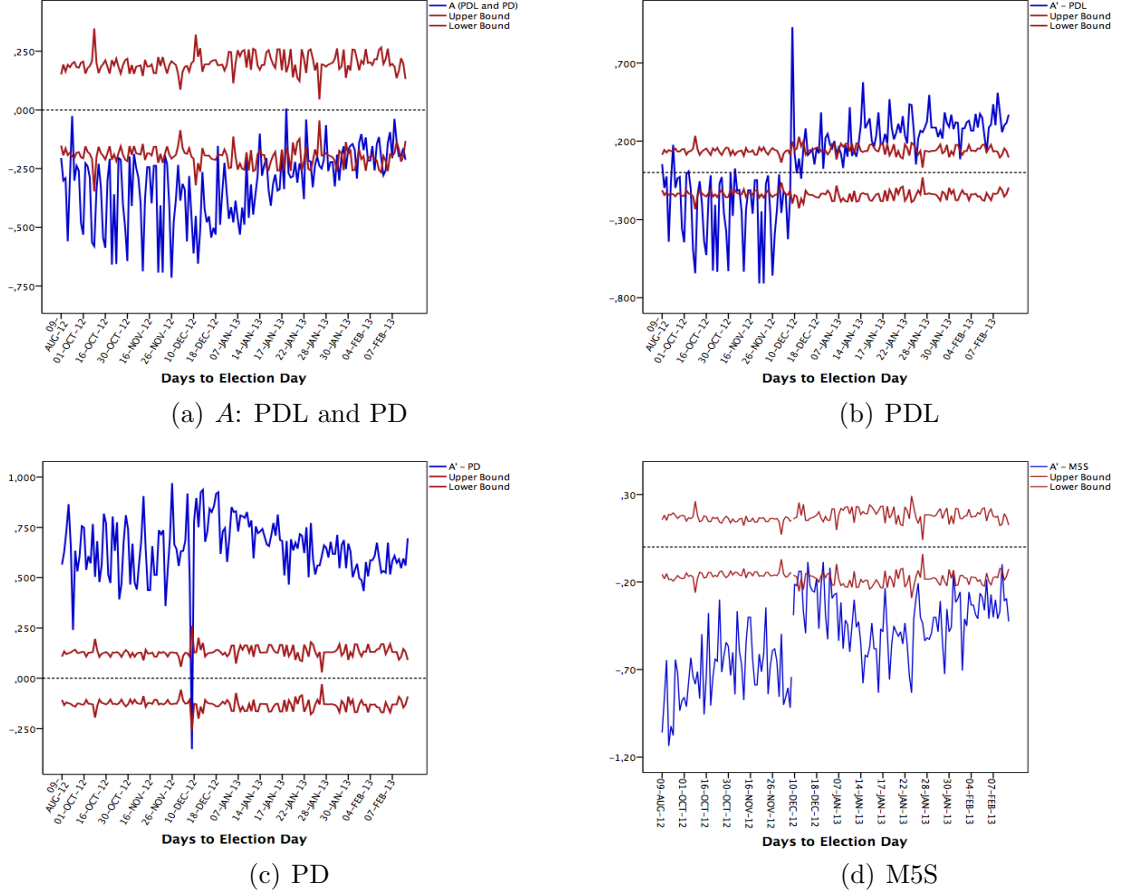
To look in more depth at these results, figure 6.2 shows the values of A and A' measures and their confidence intervals over the election campaign, where the values outside the confidence interval are classified as inaccurate and vice versa.

According to figure 6.2(a), the trend of values of A was steadily unstable over a large part of the election campaign. As can be seen in the figure and as was pointed out earlier, the percentage of polls classified as inaccurate decreases closer to Election Day. Therefore, it may be possible to argue that in the very last days of the election campaign when it was still possible to publish polls, their overall

performance was more accurate than in the previous months.

Figure 6.2: Accuracy values applying A and A' measures and their confidence intervals: Popolo Delle Libertà, Partito Democratico and Movimento 5 Stelle

y-axis = accuracy values using the formula 3.1, 6.1, A.17, A.18 for panel (a), (b), (c) and (d) respectively.
x-axis = days on which poll readings are taken.



According to figure 6.2(b) and table 6.2, the percentage of polls classified as inaccurate for the Popolo delle Libertà increases as the number of days between the time the poll has been carried out and the Election Day decreases. Indeed, figure 6.2(b) clearly shows that almost all the values of A' dated before December are negative and different from 0 which in a few cases reach the line of 0 (representing perfect agreement between poll readings and actual election results). After December, all

the values become positive and fall outside the confidence interval for the last two weeks of the election campaign. Conversely, the poll readings in the 2008 general election initially overestimated the Popolo della Libertà and underestimated it in the last part of the election campaign.

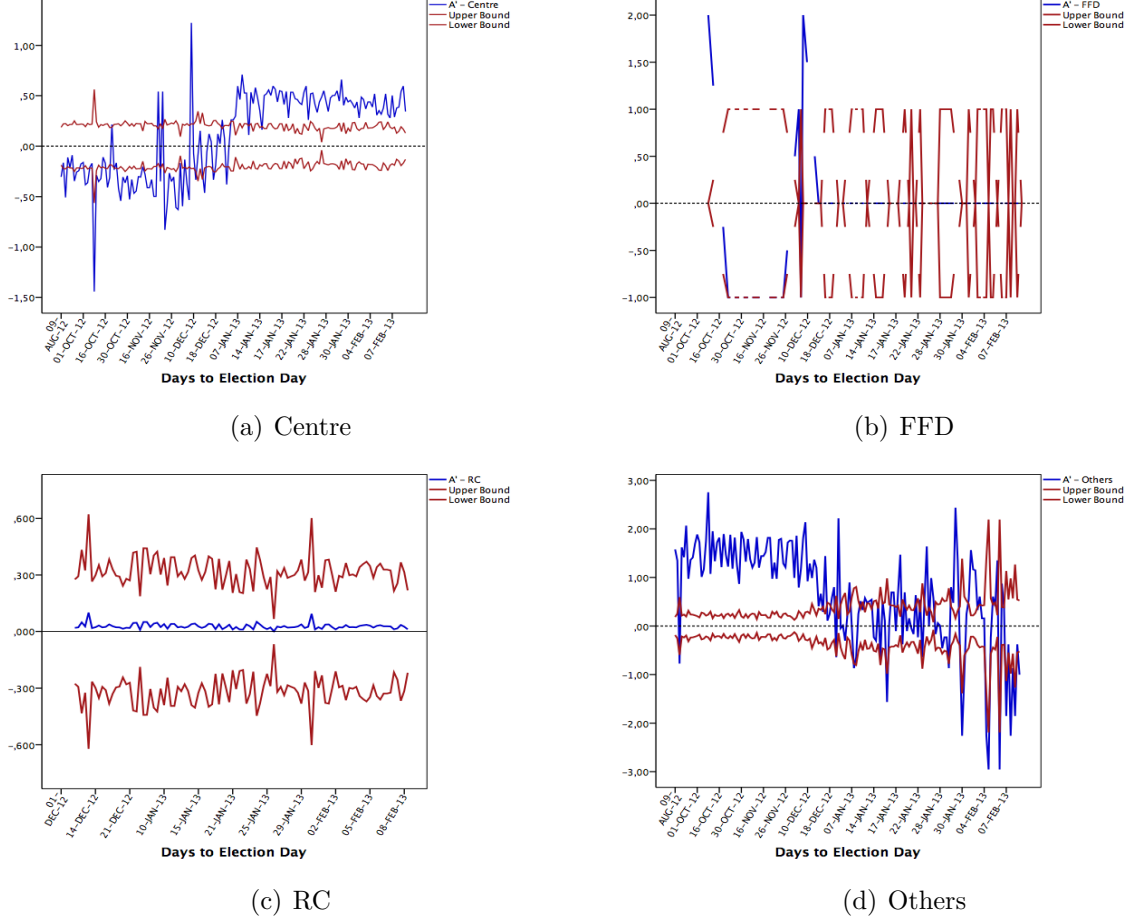
Regarding the Partito Democratico, figure 6.2(c) shows that all the values of A' largely fall outside the confidence interval above the line of 0. In the light of this, we can argue that the polls seriously overestimated the electoral performance of the Partito Democratico with more magnitude than the previous two elections. In other words, Italian pollsters constantly overestimated the centre-left coalition across time.

According to table 6.2, the anti-system movement (M5S) has been constantly underestimated. This can be easily seen in figure 6.2(d) where almost all the values largely fall outside the confidence interval below the line of 0 in the first part of the election campaign and between the second part of December and early January there are A' values that fall inside the confidence interval but they are still below the line of 0.

According to table 6.2, the Centre coalition presents a similar pattern to the Partito della Libertà. This can be seen in figure 6.3(a) which shows the A' values and their confidence intervals concerning the Centre coalition. The A' values are negative and more accurate over the first part of the election campaign. Around mid-November, the accuracy values are negative and fall inside the confidence intervals. However, as already pointed out, over the last two months of the election campaign

Figure 6.3: Accuracy values applying A' measures and their confidence intervals: Centre, Fare per Fermare il Declino, Rivoluzione Civile and Others

y-axis = accuracy values using the formula A.19, A.21, A.20, and A.22 for panel (a), (b), (c), and (d) respectively.
x-axis = day on which poll readings were taken.



almost all A' values fall outside the confidence interval assuming positive values. In the light of this, we can argue that the polls were not able correctly to predict the electoral performance of this coalition, especially during the final rush of the election campaign. This may be due to the incumbent effect of Prime Minister candidates for this coalition. As figure 6.3(b) shows, the A' values for Fare per Fermare il Declino party almost always fall inside the confidence interval becoming more accurate closer to Election Day (see also table 6.2). Regarding the small

party Rivoluzione Civile, figure 6.3(c) shows its constant overestimation over the campaign, shown in the A' values falling outside the upper bound of 95% level of significance. Figure 6.3(d) shows that the A' values for the Others coalitions fall outside upper bound of the 95% level of significance especially over the first four months of the election campaign. However, the last two months are characterized by the presence of A' values significantly different from 0 both positive and negative.

Table 6.3: 2013 Italian General Election polls on Chamber of Deputies: monthly average and percentage of inaccuracy of A' , and B_w using three parties/coalitions

The percentages A' measures refer to their values falling outside the 95% confidence interval. The A' measures is computed using only three parties/coalitions competing the election (formula 6.3, A.29, and A.30). The percentages for the B_w measure refer to proportion of their values that are statistically biased on the basis of the χ^2 test using $p \leq 0.05$ threshold. The B_w measure is computed using the formula 3.5.

| | | PDL | PD | M5S | B_w |
|------------------------|---------|--------|--------|--------|-------|
| 9 Aug - 9 Sept | average | -0.085 | -0.968 | 0.406 | 0.394 |
| | % | 33 | 100 | 100 | 100 |
| 10 Sept - 9 Oct | average | -0.226 | 0.806 | -0.927 | 0.426 |
| | % | 64 | 100 | 100 | 100 |
| 10 Oct - 9 Nov | average | -0.299 | 0.758 | -0.722 | 0.383 |
| | % | 68 | 100 | 100 | 100 |
| 10 Nov - 9 Dic | average | -0.291 | 0.812 | -0.724 | 0.465 |
| | % | 75 | 100 | 96 | 100 |
| 10 Dic - 9 Jan | average | 0.4491 | 0.179 | -0.055 | 0.438 |
| | % | 100 | 100 | 28 | 100 |
| 10 Jan - 9 Feb | average | 0.656 | 1.047 | -0.143 | 0.392 |
| | % | 100 | 100 | 38 | 100 |

Table 6.3 compares the monthly averages of A' and B_w measures applied only to

three coalitions (Popolo della Libertà, Partito Democratico, and Movimento 5 Stelle) and percentages of polls classified as inaccurate and statistically biased using the χ^2 test. The table reports similar outcomes to the previous table (6.2) with regard to the two main coalitions of the centre-right and -left and the Movimento 5 Stelle. Although the sign of the monthly average for the Popolo della Libertà changes from negative in the first four months to negative in the last two when applying the A' measure to all the coalitions, the timing of predictive inaccuracy is the opposite. In other words, table 6.2 reports that the percentage of polls classified as accurate increases closer to Election Day but when applying the A' to only three coalitions, the percentage of these polls decreases closer to Election Day. Instead, the outcomes provided by table 6.3 concerning the Partito Democratico are consistent with those in table 6.2. Thus, there was a constant overestimation during the election campaign reaching 100% of monthly percentages of polls classified as inaccurate. Concerning the Movimento 5 Stelle, table 6.3 documents the same pattern as table 6.2. Indeed, the anti-system movement has been constantly underestimated over the election campaign. The percentages of polls classified as inaccurate suddenly drops from 100% over the first four months to 28% and 38% in the last two months of the election campaign. According to table 6.3, the degree of error estimated by B_w using only three parties/coalitions in the computing process shows a very similar pattern to that obtained when using all the competing parties/coalitions. Indeed, the monthly averages reported in table 6.3 are fairly stable across time with a slight decrease over the last two months of the campaign. Moreover, percentages of

statistically biased polls on the basis of the χ^2 test steadily stand at 100%.

6.3 House Effect Results

The previous section showed that in the 2013 Italian general election there was a high percentage of polls classified as inaccurate in the poll readings without regard to the coalitions. Indeed, this has been confirmed by applying all the accuracy measures employed (A , A' , and B_w). Specifically, the Popolo della Libertà and Centre coalitions were underestimated in first part of the election campaign on the one hand and on the other hand the Partito Democratico was constantly overestimated over the entire election campaign, shown by positive values significantly different from 0 (see table 6.2). In addition, the anti-system movement, Movimento 5 Stelle, was the only coalition constantly underestimated over the entire election campaign. Therefore, what causes this high percentage of inaccuracy? In this thesis, two hypotheses have been described concerning the causes of inaccuracy: the house effect and voters sentiment changes. In this section, we undertake a statistical analysis of the house effect. The latter refers to biases caused by the methodologies employed by different polling institutions.

The model proposed by Erikson and Wlezien (1999) assumes that the variance of poll readings from one day to the next is caused by the house effect. To estimate it, they regress with no intercept poll readings in a set on $N-1$ polling houses and k dummy variables for each day with at least one poll reading (see formula 3.6).

The coefficient of day dummy variables expresses the house effect. In addition, they employ the lowess procedure proposed by Cleveland (1979) to estimate the presence of random error in the series. In order to estimate which methodology used by polling houses most affects the predictive accuracy of Italian polling, we employ a multivariate regression model where A , A' and B_w are the dependent variables (see formula 3.15).

6.3.1 Findings

As for the accuracy measures, the house effect model proposed by Erikson and Wlezien (1999) has been developed on the basis of the American system. Therefore, to fit with the Italian case, we apply the OLS to each coalition. In other words, we will regress the poll readings for each coalition on a set of 14 dummy polling house variables ($N - 1$) and 78 dummy variables for each day with at least one poll reading. Then, we will apply the lowess procedure in order to estimate the amount of random error in the series. Applying this model to each coalition will allow us to estimate the house effect separately. In other words, it may be possible that the methodologies employed by different polling houses affect one coalition more than the others. Tables 6.4 and 6.5 present the outcomes of three models to investigate the house effect in the polls published over the 2013 general election. Specifically, the first table (6.4) refers to the models using the poll readings for each coalition as dependent variables. The second table (6.5) refers to the models using the values of A , A' , and B_w applied both to all coalitions and only to three

coalitions as dependent variables. As already explained in the previous two chapters concerning the 2006 and 2008 general elections, the reason for using the accuracy values measures as dependent variable lies with the main purpose of investigating the causes of inaccuracy in depth. In other words, the use of the values of A and two versions of A' as dependent variables rather than the poll readings allows us to estimate how much of their variance over the days is due to the house effect. Recalling the expectation, the variance of days and houses explains the variance of poll readings and accuracy values: it is due to inaccuracy. We will discuss the results of poll readings and accuracy values as dependent variables. For the sake of simplicity, the discussion of the evidence provided by table 6.4 will be presented for each model separately.

Table 6.4: 2013 Italian General Election polls on Chamber of Deputies: House Effect analysis using OLS regression with no intercept and poll readings as dependent variable.

The OLS regression model refers to the formula 3.12.

(*) The statistical level of significance for the ANOVA test follows the rule: 1% = $p < 0.01$; 5% = $p < 0.05$; 10% = $p < 0.10$

| | PDL | PD | M5S | Centre | FFD | RC | Others |
|---------------------------------|-------|-------|-------|--------|-------|-------|--------|
| Model 1: Days | | | | | | | |
| R^2 | 0.97 | 0.99 | 0.98 | 0.95 | 0.95 | 0.98 | 0.85 |
| Adjusted R^2 | 0.94 | 0.98 | 0.97 | 0.91 | 0.89 | 0.97 | 0.71 |
| ANOVA* (sign.) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Model 2: Houses | | | | | | | |
| R^2 | 0.98 | 0.98 | 0.98 | 0.93 | 0.96 | 0.96 | 0.77 |
| Adjusted R^2 | 0.98 | 0.98 | 0.98 | 0.92 | 0.95 | 0.96 | 0.75 |
| ANOVA* (sign.) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Model 3: Days and Houses | | | | | | | |
| R^2 | 0.99 | 0.99 | 0.99 | 0.98 | 0.99 | 0.99 | 0.94 |
| Adjusted R^2 | 0.98 | 0.99 | 0.99 | 0.96 | 0.98 | 0.97 | 0.86 |
| ANOVA* (sign.) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Table 6.4 reports the outcomes of OLS regressions using the poll readings for each coalition as dependent variables. Regarding the first model where the poll readings are regressed with no intercept on the days dummy variables, overall the *Adjusted R²* is higher than 0.80 for the coalitions, except for Others. In addition, all the regressions meet the highest level of statistical significance using the ANOVA test. However, this is consistent with the outcomes of the previous two general elections, where the poll readings for the group of the small parties not aligned with any coalition are less affected by the variance of days. In the second model, poll readings for each coalition are regressed on the polling house dummy variables. As for the previous model, table 6.4 provides evidence of high *Adjusted R²*, which varies between 0.75 and 0.98. Indeed, in this model too the coalition of Others is affected less by houses than the rest of the coalitions. In addition, these results are higher than in the two previous elections (see tables 4.3 and 5.4). Moreover, all the regressions meet the highest level of statistical significance using the ANOVA test. In the third model, we fully apply the model proposed by Erikson and Wlezien (1999) regressing poll readings on days and polling houses dummy variables. As reported in table 6.4, the *Adjusted R²* varies between 0.86 and 0.99. Also, the full model presents stronger evidence of the house effect than in the previous two models. Specifically, poll readings concerning the Partito Democratico and Movimento 5 Stelle are the most affected by the house effect reaching the 0.99 as *Adjusted R²*. Moreover, all the regressions meet the highest level of statistical significance using the ANOVA test. In the light of this evidence, one of the hypotheses of this thesis has been strongly

confirmed by all the models employed.

Table 6.5 reports the outcomes using the accuracy values for each coalition as dependent variables. Specifically, the first panel of table refers to the accuracy values when applying the formula 6.1, A.17, A.18, A.19, A.20, A.21, and A.22 (see Appendix) and the B_w measure. The second panel of the table refers to the accuracy values when applying the formula 6.3, A.29, and A.30 (see Appendix) and B_w measure. The third panel refers to accuracy values when applying the measure of A (formula 3.1). For the sake of simplicity, we will discuss the evidence provided by table 6.5 for each model separately as for the previous table.

Table 6.5: 2013 Italian General Election polls on Chamber of Deputies: House Effect analysis using OLS regression with no intercept and accuracy values as dependent variable.

In the first panel, the dependent variable is the accuracy values series for the given party/coalition using the formula 6.1, A.17,A.18,A.19, A.20,A.21, and A.22 respectively. The OLS regression model refers to the formula 3.13. The column called ' B_w ' refers to the error estimated series using the formula 3.5 taking into account all the parties/coalitions. The OLS regression model refers to the formula 3.14. In the second panel, the dependent variable is the accuracy values series using the formula 6.3, A.29, and A.30. The column called ' B_w ' refers to the error estimated series using the formula 3.5 taking into account only three parties/coalitions. The column called ' A ' refers to the accuracy values series computed using the formula 3.1 (PDL and PD) as dependent variable. The OLS regression model refers to the formula 3.13.
(*) The statistical level of significance for the ANOVA test follows the rule: 1% = $p < 0.01$; 5% = $p < 0.05$; 10% = $p < 0.10$

| | PDL | PD | M5S | Centre | FFD | RC | Others | B_w | CR: PDL | CL: PD | M5S | B_w | A |
|---------------------------------|-------|-------|-------|--------|-------|-------|--------|-------|---------|--------|-------|-------|-------|
| Model 1: Days | | | | | | | | | | | | | |
| R^2 | 0.84 | 0.98 | 0.94 | 0.85 | 0.86 | 0.96 | 0.72 | 0.86 | 0.96 | 0.99 | 0.93 | 0.82 | 0.95 |
| Adjusted R^2 | 0.69 | 0.97 | 0.89 | 0.71 | 0.68 | 0.94 | 0.46 | 0.73 | 0.93 | 0.98 | 0.86 | 0.65 | 0.91 |
| ANOVA* (sign.) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Model 2: Houses | | | | | | | | | | | | | |
| R^2 | 0.27 | 0.96 | 0.90 | 0.35 | 0.82 | 0.93 | 0.56 | 0.92 | 0.40 | 0.96 | 0.66 | 0.90 | 0.87 |
| Adjusted R^2 | 0.21 | 0.96 | 0.89 | 0.29 | 0.78 | 0.92 | 0.52 | 0.91 | 0.35 | 0.96 | 0.63 | 0.89 | 0.85 |
| ANOVA* (sign.) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Model 3: Days and Houses | | | | | | | | | | | | | |
| R^2 | 0.91 | 0.99 | 0.98 | 0.90 | 0.96 | 0.97 | 0.90 | 0.94 | 0.98 | 0.99 | 0.98 | 0.93 | 0.98 |
| Adjusted R^2 | 0.80 | 0.97 | 0.97 | 0.77 | 0.87 | 0.94 | 0.76 | 0.87 | 0.96 | 0.98 | 0.96 | 0.84 | 0.95 |
| ANOVA* (sign.) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

In the first model (dummy days as explanatory variables), *Adjusted R²* varies between 0.46 and 0.96, which shows a different degree of house effect in the series of accuracy values. Specifically, the lower *Adjusted R²* belongs to Popolo delle Libertà, Fare per Fermare il Declino, and Others. This is consistent with the results for the accuracy measure, where the poll readings present the lowest overall performance in terms of inaccuracy percentages. However, all the regressions meet the highest level of statistical significance using the ANOVA test. Applying this model, there is evidence with varying magnitude that the accuracy of poll readings is affected by the days. This is clear when comparing the outcomes from the accuracy values of poll readings of Popolo delle Libertà in the first panel with those on the second one, where the *Adjusted R²* is 0.93. This is an interesting outcomes because in previous chapters the same procedure applied to Others provided the same evidence regarding the degree of impact by days on poll readings. In the second model (dummy polling house as explanatory variables), the values of *Adjusted R²* vary between 0.21 and 0.96. Also in this model, the lower *Adjusted R²* belongs to Popolo delle Libertà but it does not change so much in the panel overall. Table 6.5 provides less strong evidence concerning the impact of the house effect on the accuracy values compared with model 1 and, also, with the 2006 election where the *Adjusted R²* values vary between 0.65 and 0.96. This is also confirmed by the evidence provided in panels 2 and 3, where the degree of variation of accuracy among the series depends on the polling houses with different extents. For instance, the accuracy values for the Movimento 5 Stelle is less affected by polling houses when the A' is applied only to

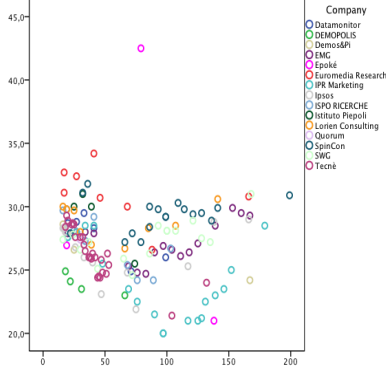
three coalitions (see formula A.30) than when it is applied to all coalitions (A.18). Moreover, all the regressions meet the highest level of statistical significance using the ANOVA test. In the third model (dummy days and polling houses as explanatory variables), the *Adjusted R²* varies between the 0.76 and 0.96 in the series. Therefore, when applying the full model there are higher values of *Adjusted R²* than in the previous two models. Moreover, the evidence provided in table 6.5 confirm that the accuracy values concerning the poll readings for Popolo delle Libertà and Others are the least affected by the house effect. This is consistent with the previous two general elections. Also in this model, all the regressions meet the highest level of statistical significance using the ANOVA test. According to this evidence, the hypothesis concerning the house effect as the main cause of inaccuracy in Italian polling has been confirmed by all three models employed.

Figure 6.4 shows the correlation between the house-adjusted poll readings for the Popolo delle Libertà and the number of days between poll readings and Election Day using linear and smoothed scatter plots. Figure 6.4(a) does not show a clear relationship between them and, therefore, it is not easy to argue whether the house effect increases or decreases closer to Election Day. Despite the high variance explained by the house effect among the series, the linear scatter plot also shows a certain amount of error. In order to estimate the latter in the house-adjusted series for each coalition, we will employ a well-established statistical procedure designed by Cleveland (1979): the lowess. We will apply the following bandwidth for each

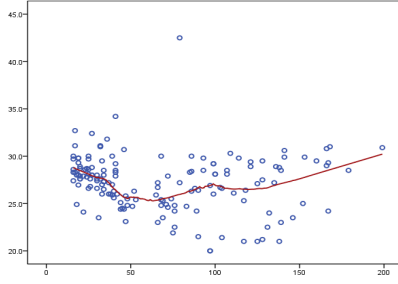
Figure 6.4: Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Popolo Delle Libertà

y-axis = house-adjusted polls the poll readings. x-axis = number of days remaining before Election Day.

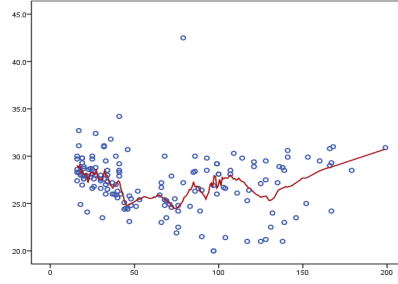
The smoothed scatter plot is computed following the model 3.7.



(a) Linear



(b) Smoothed: Bandwidth = 0.30



(c) Smoothed: Bandwidth = 0.10

smoothed house-adjusted series: 0.40, 0.30, 0.20, and 0.10⁸. For the sake of simplicity, we report only the smoothed scatterplot using the bandwidth of 0.30 and 0.10 given that they generate a better fitted line for the purpose of this thesis.

Therefore, figures 6.4(b) and 6.4(c) show the smoothed versions using different bandwidths (0.30 and 0.10) for the Popolo delle Libertà.

The bottom right panel (6.4(c)) shows the fitted line using the bandwidth of

⁸We also applied the bandwidth 0.05, which is considered the most robust in order to estimate the random error, but the all the scatterplots obtained were illegible because the fitted lines were outside the box figure. Please refer to the Appendix for the smoothed scatterplot with bandwidth 0.40 and 0.20

0.10, which is able to closely follow the series with a lower random error than the other panel. Indeed, the latter(6.4(b)) reports a less sensitive smoothed series in representing the random error. Therefore, the outcomes provided by the lowess procedure confirm that inaccuracy of poll readings for the Popolo delle Libertà is not only due to the house effect but there is also a degree of random error caused by other factors.

Figure 6.5: Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Partito Democratico

y-axis = house-adjusted polls the poll readings. x-axis = number of days remaining before Election Day.
The smoothed scatter plot is computed following the model 3.7.

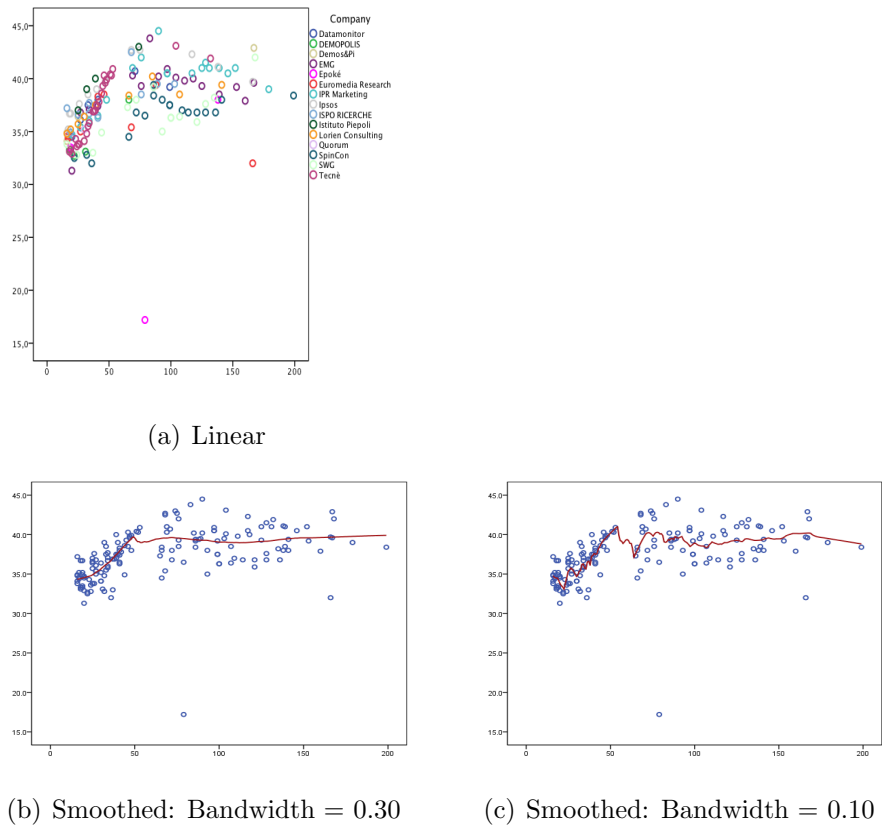


Figure 6.5 shows the correlation between the house-adjusted poll readings for the Partito Democratico and the number of days between poll readings and Election Day

using linear and smoothed scatter plots. According to figure 6.5(a), there is a slight positive correlation between them: the house effect decreases closer to Election Day. All the values in the last 50 days are comprised between 30% and 35% of the share. However, during the first part of the election campaign, figure 6.5(a) shows a lot of dispersion in the series with house-adjusted poll readings varying between 35% and 45% of the share. Therefore, the greater the difference between the Election Day and the poll readings, the higher the dispersion in them. This is also consistent with the evidence provided by accuracy (see table 6.2) and the house effect (see tables 6.4 and 6.5) analysis.

Using the lowess procedure, the series presents a similar pattern to Popolo della Libertà. Figures 6.5(b) and 6.5(c) show the presence of random error in the series⁹. As expected, the lower the bandwidth, the more the new values created by the smoothed version follow the house-adjusted series. In the light of this evidence, we may argue that there are also other factors that affect the accuracy of poll readings for the Partito Democratico.

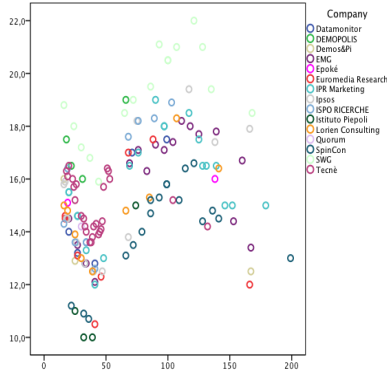
Figure 6.6 shows the correlation between the house-adjusted polls for the Movimento 5 Stelle and the number of days between polls and Election Day using linear and smoothed scatter plots. According to figure 6.6(a), it is not possible to draw any relationship between them due to the high presence of dispersion throughout the series. However, this is consistent with the previous analysis presented in this

⁹Moreover, all the other series created using higher bandwidth are very similar to each other, which means that none of them are able to estimate correctly the degree of random error in the Partito Democratico house-adjusted series. Please refer to the Appendix to see figures.

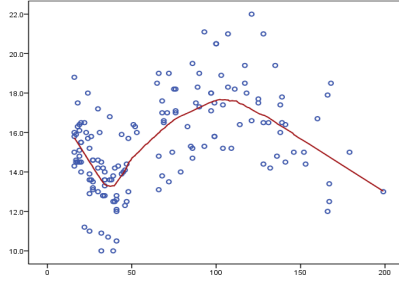
Figure 6.6: Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Movimento 5 Stelle

y-axis = house-adjusted polls the poll readings. x-axis = number of days remaining before Election Day.

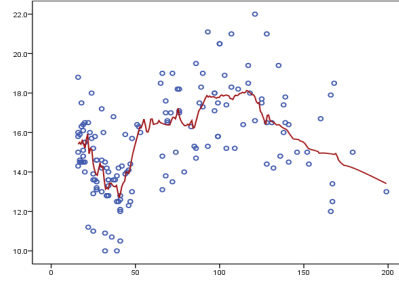
The smoothed scatter plot is computed following the model 3.7.



(a) Linear



(b) Smoothed: Bandwidth = 0.30



(c) Smoothed: Bandwidth = 0.10

chapter concerning the accuracy and the house effect in the poll readings for the Movimento 5 Stelle. In other words, the high percentages of polls classified as inaccurate is certainly due to the strong presence of the house effect, but also to the high amount of error in the series. To look in more depth, we will apply the lowess procedure with different bandwidth (0.30 and 0.10) in order to estimate correctly the random error in the house-adjusted poll readings.

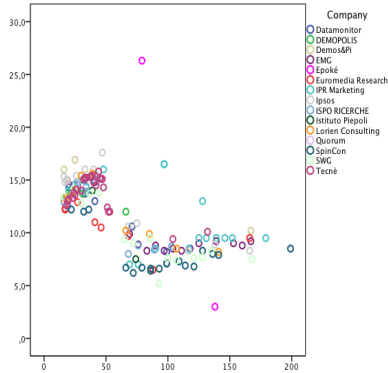
According to figures 6.6(b) and 6.6(c), the lower bandwidth follows the series more closely than the other series. Despite this, the smoothed series shows a high

presence of random error which allows us to argue that the high percentage of polls classified as inaccurate could also be due to factors other than the strong house effect revealed in the previous analysis.

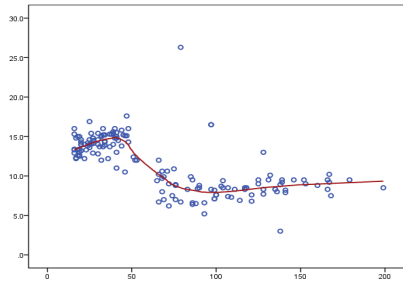
Figure 6.7: Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Centre

y-axis = house-adjusted polls the poll readings. x-axis = number of days remaining before Election Day.

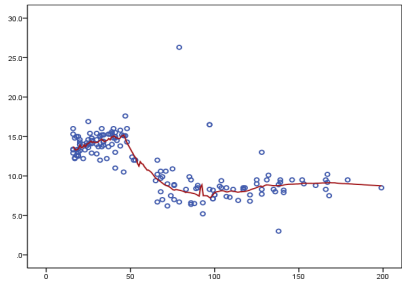
The smoothed scatter plot is computed following the model 3.7.



(a) Linear



(b) Smoothed: Bandwidth = 0.30



(c) Smoothed: Bandwidth = 0.10

Figure 6.7 shows the correlation between the house-adjusted poll readings for the Centre coalitions and number of days between poll readings and Election Day using linear and smoothed scatter plots. According to figure 6.7(a), there is a negative correlation between them: the accuracy of poll readings decreases closer to Election Day. This is especially consistent with the evidence provided in table 6.2 concerning

the monthly average of A' measure. In other words, the percentage of polls classified as inaccurate for the Centre coalition increases closer to Election Day. In addition, figure 6.7(a) shows a lower dispersion in the series compared with the previous three coalitions.

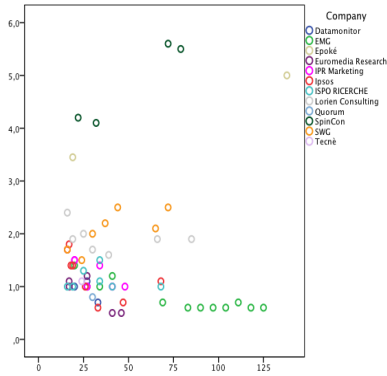
Therefore, we apply the lowess procedure in order to estimate the degree of random error in the house-adjusted poll readings for the Centre coalition. In the bottom right panel (6.7(c)), the new values created by the smoothed version are able to estimate the random error in the series. In other words, the smoothed series closely follows the house-adjusted series presenting lower random error compared to the other smoothed series (6.7(b)). With this in mind, we may argue that the house-adjusted poll readings for the Centre coalition were affected by the house effect as also confirmed by the previous analysis, but the low presence of random error suggests that other factors may have caused the high percentage of inaccuracy (particularly at the end of the election campaign): for instance, voters sentiment change.

Figure 6.8 shows the correlation between the house-adjusted poll readings for the Fare per Fermare il Declino coalitions and the number of days between poll readings and Election Day using linear and smoothed scatter plots. According to figure 6.8(a), it is not possible to draw any relationship between them due to the high presence of dispersion in the series. Therefore, we apply the lowess procedure in order to estimate the degree of random error among the house-adjusted poll readings. In the bottom right panel (6.8(c)), the new values created by smoothed

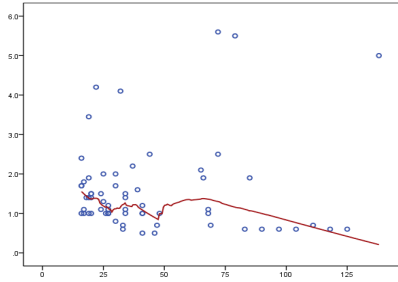
Figure 6.8: Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Fare per Fermare il Declino

y-axis = house-adjusted polls the poll readings. x-axis = number of days remaining before Election Day.

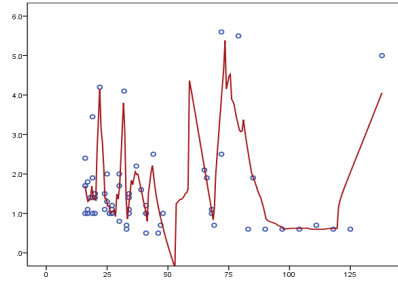
The smoothed scatter plot is computed following the model 3.7.



(a) Linear



(b) Smoothed: Bandwidth = 0.30



(c) Smoothed: Bandwidth = 0.10

versions are able to estimate the random error in the series, which is high.

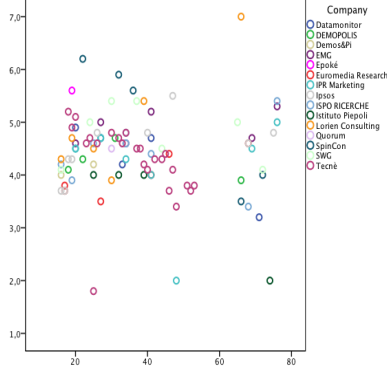
Regarding the small party of Rivoluzione Civile, figure 6.9(a) does not show a clear relationship between polls and the number of days to Election Day. Indeed, there is the presence of high dispersion in the series where the values vary between 2% and 7% of the share. By applying the lowess, figure 6.9(c) documents the low presence of random error and, therefore, does not closely follow the series as for the other parties/coalitions.

Figure 6.10 shows the correlation between house-adjusted polls for the small

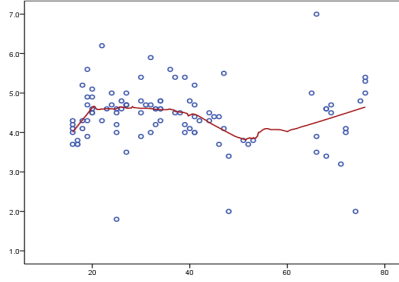
Figure 6.9: Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Rivoluzione Civile

y-axis = house-adjusted polls the poll readings. x-axis = number of days remaining before Election Day.

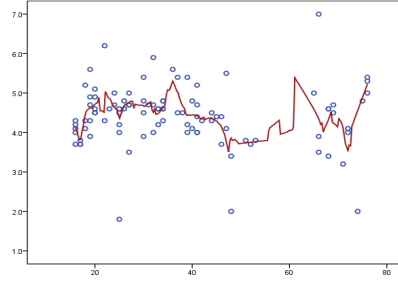
The smoothed scatter plot is computed following the model 3.7.



(a) Linear



(b) Smoothed: Bandwidth = 0.30



(c) Smoothed: Bandwidth = 0.10

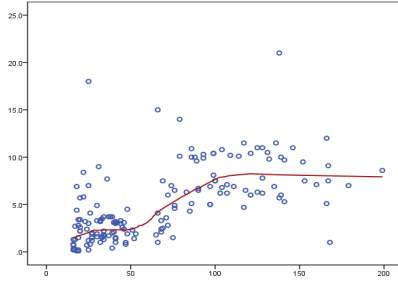
coalitions of Others parties using linear and smoothed scatter plots. According to figure 6.10(a), there is a positive relationship between the house-adjusted polls and the number of days to the Election Day. However, the smoothed scatter plots (6.10(d) and 6.10(c)) do not report a strong presence of random error in the polls series for the Others. Therefore, we may argue that other factors caused the inaccuracy of polls.

As the aim of this thesis is to ascertain the factors that cause bias in Italian polling, we employ a multivariate regression model using the methodologies used

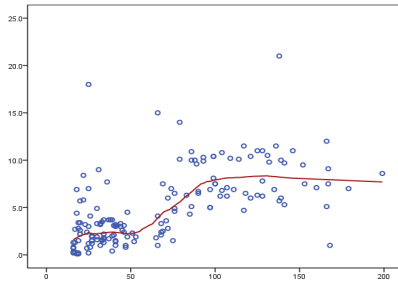
Figure 6.10: Linear and smoothed scatter plots of house-adjusted polls aggregated by date: Others

y-axis = house-adjusted polls the poll readings. x-axis = number of days remaining before Election Day.

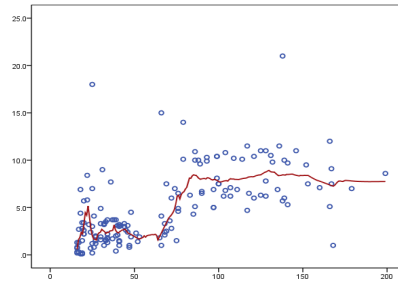
The smoothed scatter plot is computed following the model 3.7.



(a) Linear



(b) Smoothed: Bandwidth = 0.30



(c) Smoothed: Bandwidth = 0.10

by different polling houses as explanatory variables (see model 3.15). Recalling the model, we regress the accuracy index on a set of dummy variables for each methodology employed as documented by polling houses and an exogenous variable (the difference between the two main parties/coalitions as reported by poll readings) to estimate the house effect. Specifically, we take into account the sampling procedure (random and no-random), the delivery method (CATI and CAWI), who commissioned the poll (media, polling house, and political parties) and where its results have been disseminated (TV, newspapers, and the Internet). For each dummy variables we expect a different relationship with the accuracy index. Accordingly, the main expectation is a positive relationship between the accuracy index and the fol-

lowing variables: no-random sample, CATI, CAWI, media and political parties as buyers, and the difference between the two main parties/coalitions estimated in the poll readings (hereafter referred to as DCEP). For instance, the use of no- random sampling procedure increases the inaccuracy (error) of poll readings¹⁰. For the rest, we expect a negative relationship and, therefore, these variables increase (decrease) the accuracy (error) in Italian polling. Table 6.6 reports the results of this model applied to the 2013 Italian General Elections using the two overall accuracy indexes A and B_w as dependent variables. For the sake of simplicity, the results will be discussed for each accuracy measure separately.

We start by considering the model where B_w is the dependent variable. According to table 6.6, the error estimated in poll readings has been affected by the actors who commissioned the polls without taking into account the number of parties/coalitions. Specifically, there is a strong significant relationship between these variables and the estimated error. This outcome fulfills our assumptions concerning the Media and Polling House variables. Indeed, we expect that the Political Party as commissioner is a source of bias and, therefore, error. The outcomes of the models employing different versions of the B_w measure as dependent variables differ only by the fact that using three parties/coalitions in the computing process, the DCEP has a strongly significant positive relationship with it ($\beta = 0.005$ $p < 0.01$). This does not occur when all the parties/coalitions are taken into account when computing the B_w measure. Focusing on the model where the A measure is the dependent vari-

¹⁰Please refer to section 3.3.1 of chapter 3 for further explanation.

Table 6.6: House effect across the 2013 Italian General Election polls on Chamber of Deputies: Multivariate Regression model using A and B_w measures as dependent variables.

The model is computed using formula 3.15, where set of methodologies employed by the polling house and the difference between the two major party/coalitions (referred as DCEP) are the explanatory variables. The A and B_w measures used as dependent variables are computed using the formula 3.1 and 3.5. The standard errors for the coefficient are in parentheses and the statistical level of significance follows the rule: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

| | B_w (7 Par./Coal.) | B_w (3 Par./Coal.) | A |
|--------------------|-----------------------------|-----------------------------|----------------------------|
| Random | -0.032 (0.027) | -0.036 (0.030) | -0.007* (0.004) |
| Other Sample | 0.049 (0.031) | 0.028 (0.035) | -0.001 (0.004) |
| CATI | 0.032 (0.028) | 0.027 (0.031) | 0.013*** (0.004) |
| CAWI | 0.042 (0.044) | 0.002 (0.049) | 0.015** (0.006) |
| B: Media | -0.705*** (0.104) | -0.833*** (0.115) | -0.020 (0.012) |
| B: Polling House | -0.711*** (0.103) | -0.839*** (0.114) | -0.018 (0.023) |
| B: Political Party | -0.779*** (0.157) | -0.922*** (0.174) | -0.20 (0.017) |
| M: TV | -0.042 (0.050) | -0.049 (0.056) | 0.003 (0.007) |
| M: Newspaper | -0.036 (0.048) | -0.053 (0.053) | 0.002 (0.006) |
| M: Internet | -0.030 (0.056) | -0.210 (0.062) | -0.003 (0.007) |
| DCEP | 0.002 (0.002) | 0.005*** (0.002) | 0.032*** (0.00) |
| Constant | 1.175*** (0.084) | 1.314*** (0.092) | 0.033** (0.016) |
| R^2 | 0.393 | 0.436 | 0.999 |
| Adjusted R^2 | 0.347 | 0.394 | 0.998 |
| ANOVA | 0.000 | 0.000 | 0.000 |

able, the predictive accuracy of polls is affected by the following variables: Random, CATI, CAWI, and DCEP. The sign of their coefficient comprises the house effect as assumed. In other words, the use of random sampling procedures increases the predictive accuracy of poll readings ($\beta = -0.007$ $p < 0.10$) whereas the two delivery systems included in the model and the DCEP have a strong opposite effect (see last column of table 6.6). This is consistent with the results of the analysis discussed so far. Table 6.7 reports the outcomes of the multivariate regression model applied to the A' measures for all the parties/coalitions as dependent variables. As with the other analysis, we discuss the results for each coalition separately. We start by considering the model where the A' measure for the Popolo della Libertà is the dependent variable.

According to table 6.7, the house effect on the predictive accuracy of poll readings for this coalition is comprised of the following variables: CAWI, Media (as buyer), Polling House, Political Party, DCEP. Specifically, most of them present a significant positive relationship with the dependent variable and, then, they decrease the predictive accuracy of poll readings. This fulfills our expectation only in part given that we assumed that when a poll is carried out on a Polling House's own initiative, the predictive accuracy increases. This also occurred for the CAWI delivery system, showing a significant negative relationship with the A' measure for the Popolo della Libertà.

Regarding the model where the A' measure for the Partito Democratico is the dependent variable, the evidence provided by table 6.7 shows that the CATI delivery

Table 6.7: House effect across the 2013 Italian General Election polls on Chamber of Deputies: Multivariate Regression model using A' measures as dependent variables.

The model is computed using formula 3.15, where set of methodologies employed by polling house and the difference between the two major party/coalitions (referred as DCEP) are the explanatory variables. The A' measures used as dependent variables are computed using the formula 6.1, A.17, A.18, A.19, A.20, A.21, and A.22. The standard errors for the coefficient are in parentheses and the statistical level of significance follows the rule: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

| | PDL | PD | M5S | Centre | FFD | RC | Others |
|--------------------|----------------------------|-----------------------------|-----------------------------|-----------------------------|---------------------------|-----------------------------|----------------------------|
| Random | 0.044 (0.041) | 0.005 (0.017) | 0.097** (0.049) | 0.167* (0.086) | -0.233 (0.202) | -0.247*** (0.055) | 0.046 (0.218) |
| Other Sample | -0.027 (0.048) | 0.006 (0.020) | 0.014 (0.057) | -0.076 (0.120) | 0.161 (0.214) | -0.066 (0.071) | -0.156 (0.255) |
| CATI | 0.070 (0.043) | 0.059*** (0.018) | -0.093 (0.050) | 0.033 (0.090) | -0.152 (0.195) | 0.073 (0.055) | -0.422* (0.225) |
| CAWI | -0.176** (0.068) | -0.029 (0.029) | -0.337*** (0.081) | -0.462*** (0.142) | 0.151 (0.320) | 0.425*** (0.109) | 0.786** (0.359) |
| B: Media | 0.429*** (0.161) | 0.089 (0.68) | 0.464* (0.236) | -0.137 (0.335) | — — | — — | -1.530* (0.851) |
| B: Polling House | 0.413*** (0.159) | 0.104 (0.067) | 0.489* (0.237) | -0.171 (0.331) | -0.413* (0.243) | 0.184* (0.074) | -1.847** (0.840) |
| B: Political Party | 0.421* (0.243) | 0.116 (0.102) | 0.337 (0.321) | -0.023 (0.504) | -0.610 (0.592) | 0.212 (0.198) | 2.143* (1.279) |
| M: TV | -0.077 (0.078) | -0.030 (0.033) | -0.102 (0.092) | -0.036 (0.261) | — — | 0.428*** (0.110) | -0.001 (0.410) |
| M: Newspaper | 0.011 (0.074) | 0.007 (0.031) | -0.126 (0.088) | 0.120 (0.155) | 0.558** (0.249) | 0.229** (0.104) | -0.460 (0.392) |
| M: Internet | -0.042 (0.087) | -0.024 (0.037) | 0.073 (0.103) | 0.188 (0.180) | 0.193 (0.332) | 0.135 (0.121) | -0.129 (0.457) |
| DCEP | 0.041*** (0.003) | -0.023*** (0.001) | 0.006 (0.004) | 0.002*** (0.006) | 0.036** (0.018) | 0.003 (0.005) | -0.036** (0.015) |
| Constant | 0.093 (0.129) | -0.023*** (0.540) | 0.006 (0.223) | 0.022*** (0.268) | 0.036** (0.231) | 0.003 (0.133) | -0.036** (0.680) |
| R^2 | 0.644 | 0.760 | 0.185 | 0.259 | 0.330 | 0.263 | 0.239 |
| Adjusted R^2 | 0.617 | 0.740 | 0.123 | 0.203 | 0.218 | 0.178 | 0.181 |
| ANOVA | 0.000 | 0.000 | 0.001 | 0.000 | 0.006 | 0.001 | 0.000 |

system and DCEP comprise the house effect. However, our expectations are satisfied only in part given that the sign of the coefficient of DCEP variables is negative ($\beta = -0.023$ $p < 0.01$).

Moving to the model where the A' measure for the Movimento 5 Stelle is the dependent variable, table 6.7 reports that the following variables affected the predictive accuracy of poll readings: Random, CAWI, Media and Polling House. However, none of them confirms our assumptions. For instance, the CAWI delivery system has a negative relationship with the A' measure for this movement ($\beta = -0.462$ $p < 0.01$). Conversely, when the poll is carried out on the polling house's own initiative or commissioned by a media actor, its predictive accuracy decreases. What is most surprising in the evidence reported for this movement is that the use of random sampling procedure has a significant positive relationship with the dependent variable ($\beta = 0.097$ $p < 0.05$). This is also documented in the model where the A' measure for the Centre coalition is the dependent variable. Indeed, table 6.7 reports that the predictive accuracy of poll readings for this coalition decreases when using a random sampling procedure ($\beta = 0.167$ $p < 0.10$). Conversely, the CAWI delivery system shows a strong significant negative relationship with the dependent variable ($\beta = -0.462$ $p < 0.01$). In addition, the DCEP plays an important role in increasing inaccuracy in the poll readings for this coalition ($\beta = 0.002$ $p < 0.01$).

Focusing on the model where the A' measure for Fare per Fermare il Declino is the dependent variable, the house effect is showing in the Polling House, Newspaper, and DCEP variables. Our expectations concerning their relationship with the predictive

accuracy are not satisfied only for the Newspaper variable. Indeed, table 6.7 reports a significant positive relationship with the A' measure for this small party ($\beta = 0.558$ $p < 0.05$).

Concerning the model where the A' measure for Rivoluzione Civile is the dependent variable, the predictive accuracy of poll readings is affected by the following variables: Random, CAWI, Polling House, TV, and Newspaper. According to our expectations, the use of a random sampling procedure increases the accuracy of poll readings ($\beta = -0.247$ $p < 0.01$). All the rest of the variables that meet the statistical level of significance present a positive relationship with the dependent variable (see table 6.7) and they do not fulfill our expectations. What is most surprising in these results is that the two variables concerning the media used to disseminate the poll results decrease their accuracy.

Moving to the last column of table 6.7, the A' measure for the small coalition of Others has been affected by the following variables: CATI, CAWI, Media, Polling House, Political Party, and DCEP. Most of them do not satisfy our assumptions about their relationship with the dependent variable. For instance, the DCEP has a significantly negative relationship with the predictive accuracy of poll readings for this small coalition ($\beta = -0.036$ $p < 0.05$). This is also documented for the CAWI and the Political Party variables. In line with our expectations, having a Polling House and the Media as commissioner of a poll increases its predictive accuracy.

Table 6.8 reports the outcomes of the multivariate regression model applied to A' measures for only three parties/coalitions as dependent variables. As with the

previous analysis, we discuss the results for each coalition separately.

We start by considering the model where the A' measure for the Popolo della Libertà is the dependent variable. The house effect is shown in the CAWI and DCEP variables. This is in line with the results of the previous model where seven parties/coalitions are taken into account to compute the A' measure. However, in this version the three buyers' (Media, Polling House, and Political Party) variables do not meet the statistical level of significance anymore. Moving to the model where the A' measure for the Partito Democratico is the dependent variable, the predictive accuracy of poll readings for this coalition is affected by the CAWI and DCEP variables. As for the Popolo della Libertà, this has also been documented in the previous model. However, in this model the sign of the coefficient for the CAWI variable becomes negative and, therefore, its use increases the predictive accuracy of poll readings. Regarding the model using the A' measure for the Movimento 5 Stelle, the last column of table 6.8 reports similar results to those documented in the previous model (see table 6.7) except that the DCEP variable does not meet the statistical level of significance anymore.

In the light of this evidence, we may conclude that the house effect is mainly comprised in the delivery methods, buyers, and media. Specifically, the use of the CAWI delivery system during this election increases the predictive accuracy of polls in almost all the models employed. Surprisingly, the dissemination of poll results using the media has a negative effect on the accuracy of polls for the small parties. In a similar vein, this kind of relationship has only been documented also with the

Table 6.8: House effect across the 2013 Italian General Election polls on Chamber of Deputies: Multivariate Regression model using A' measures for only three parties/coalitions as dependent variables.

The model is computed using formula 3.15, where set of methodologies employed by polling house and the difference between the two major party/coalitions (referred as DCEP) are the explanatory variables. The A' measures used as dependent variables are computed using the formula 6.3, A.29, and A.30. The standard errors for the coefficient are in parentheses and the statistical level of significance follows the rule: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

| | PDL | PD | M5S |
|--------------------|-----------------------------|-----------------------------|-----------------------------|
| Random | 0.120 (0.077) | 0.063 (0.043) | 0.177** (0.078) |
| Other Sample | -0.037 (0.090) | 0.017 (0.050) | -0.010 (0.091) |
| CATI | 0.056 (0.079) | 0.042 (0.044) | -0.114 (0.080) |
| CAWI | -0.397*** (0.127) | -0.188*** (0.071) | -0.563*** (0.128) |
| B: Media | 0.421 (0.372) | 0.096 (0.208) | 0.685* (0.376) |
| B: Polling House | 0.380 (0.373) | 0.062 (0.208) | 0.669* (0.376) |
| B: Political Party | 0.347 (0.505) | 0.107 (0.282) | 0.572 (0.510) |
| M: TV | -0.152 (0.145) | 0.089 (0.081) | -0.174 (0.146) |
| M: Newspaper | 0.024 (0.139) | 0.034 (0.078) | -0.120 (0.140) |
| M: Internet | -0.040 (0.161) | -0.001 (0.090) | -0.070 (0.163) |
| DCEP | 0.063*** (0.006) | -0.019*** (0.196) | 0.019*** (0.354) |
| Constant | 0.580 (0.351) | 0.696*** (0.196) | -0.662* (0.354) |
| R^2 | 0.514 | 0.276 | 0.224 |
| Adjusted R^2 | 0.447 | 0.221 | 0.165 |
| ANOVA | 0.000 | 0.000 | 0.000 |

Polling House as buyer for the bigger parties/coalitions. Conversely, it increases the predictive accuracy of polls for the small parties (see table 6.7).

6.4 Voter Sentiment Results

Although the previous section confirmed one of the two hypotheses on which this thesis has been drawn, it is not possible to rule out completely that there was a voters sentiment change over the election campaign especially concerning the Partito Democratico and Movimento 5 Stelle. In order to estimate this movement, we will undertake a statistical analysis using two approaches. Firstly, we will estimate the error in the sample during both the last six and the last two months of the election campaign to see what evidence they provide concerning the true voters sentiment change and, therefore, the reliability of the polls. Secondly, we will employ the autoregressive model to investigate the true over time voters sentiment change in the 2013 general election using the well-established model proposed by Erikson and Wlezien (1999). Italy has a multi-party system, whereas the procedures in the literature have been developed on the basis of the US, which has a two party system. In order to estimate the true over time voters sentiment change, we will employ the autoregressive model using poll readings for each coalition as the dependent variable. Doing so, we will be able to estimate the change for each coalition and the degree of these movements.

6.4.1 Analysis of Variance

The accuracy of poll predictions may be shown by different measures on the basis of their various purposes. In this thesis, specific measures (A , A' , and B_w) have already been applied to estimate the difference between poll readings and the election outcomes. The evidence showed a high presence of inaccuracy in Italian polling over the 2013 general election, higher than in 2006 and 2008. Following the main purpose of this thesis in discovering the major and, in particular, the strongest cause of inaccuracy, we have undertaken the analysis of variance of poll readings in order to identify their amount of error and voters sentiment change. To do that, we employed the following measures: observed variance, error variance (and sampling error), true variance, and reliability. According to the evidence provided by house effect analysis, the expectation is that the presence of voters sentiment change for the seven coalitions is shown in the true variance and reliability measures.

Table 6.9 shows the outcomes of those measures covering the entire six months of the 2013 election campaign for each coalition except the Rivoluzione Civile, which appeared only in the last two months. For the sake of simplicity, we will discuss the outcomes for each coalition separately.

Table 6.9: 2013 Italian General Election polls on Chamber of Deputies: analysis of variance all sample (August - February)

The analysis of variance is applied to all the competing parties/coalitions over the six months of the campaign. The Observed Variance (OV) refers to the variance of poll readings. The Error Variance (EV) is the average of error. The Sampling Error (SE) refers to formula 3.16. The True Variance (TV) is the difference between OV and EV. The Reliability is the ratio between TV and OV.

| | PDL | PD | M5S | Centre | FFD | Others | Sample |
|-------------------|-------|-------|-------|--------|------|--------|--------|
| Mean | 27.21 | 37.46 | 15.47 | 15.47 | 1.57 | 5.06 | 1179 |
| Observed Variance | 8.45 | 10.51 | 5.62 | 11.69 | 1.31 | 14.69 | — |
| Error Variance | 1.67 | 1.98 | 1.11 | 1.11 | 0.13 | 0.41 | — |
| Sampling Error | 1.29 | 1.40 | 1.05 | 1.05 | 0.36 | 0.63 | — |
| True Variance | 6.77 | 8.53 | 4.52 | 10.58 | 1.19 | 14.29 | — |
| Reliability | 0.80 | 0.81 | 0.80 | 0.90 | 0.90 | 0.97 | — |

According to table 6.9, the poll readings concerning the Popolo delle Libertà has 8.45 as observed variance and error variance of 1.67 (sampling error: 1.29). Subtracting the error variance from the observed variance, we obtain that the true variance over the six months of the election campaign by the Popolo delle Libertà is 6.77 which means that the variance of these polls is largely due to a degree of voters sentiment movement rather than the sampling procedures employed by the polling houses. In addition, the estimate of statistical reliability (the ratio of true variance and observed variance) is 0.80, which is higher than expected. In order to estimate whether the inaccuracy over the last two months of the election campaign is also due to voters sentiment change on the basis of the house effect and lowess procedure outcomes, we will compute the analysis of variance considering only the polls carried out between 10 December 2012 and 9 February 2013.

Table 6.10 reports similar evidence for the Popolo delle Libertà. In other words, the true variance (4.06) shows a higher degree of voters sentiment than the error due to sampling procedures. In addition, the reliability is slightly lower than that reported in table 6.9 for the six months of the election campaign. Therefore, we may argue that in 2013 the inaccuracy of poll readings was also due to the voters sentiment change during the election campaign.

Table 6.10: 2013 Italian General Election polls on Chamber of Deputies: analysis of variance two months (10th Dec - 9th Feb)

The analysis of variance is applied to all the competing parties/coalitions over the last two months of the campaign. The Observed Variance (OV) refers to the variance of poll readings. The Error Variance (EV) is the average of error. The Sampling Error (SE) refers to formula 3.16. The True Variance (TV) is the difference between OV and EV. The Reliability is the ratio between TV and OV.

| | PDL | PD | M5S | Centre | FFD | RC | Others | Sample |
|-------------------|-------|-------|-------|--------|------|-------|--------|--------|
| Mean | 27.31 | 36.62 | 14.64 | 13.23 | 1.55 | 4.43 | 3.04 | 1199 |
| Observed Variance | 5.35 | 7.22 | 4.12 | 5.81 | 0.92 | 0.58 | 7.62 | — |
| Error Variance | 1.65 | 1.93 | 1.04 | 0.96 | 0.13 | 0.35 | 0.24 | — |
| Sampling Error | 1.28 | 1.39 | 1.02 | 0.98 | 0.35 | 0.59 | 0.49 | — |
| True Variance | 4.06 | 5.82 | 3.10 | 4.83 | 0.56 | -0.01 | 7.12 | — |
| Reliability | 0.76 | 0.80 | 0.75 | 0.83 | 0.61 | -0.02 | 0.93 | — |

Regarding the Partito Democratico, table 6.9 reports a higher observed variance (10.51) and error variance (1.98) than for the main coalition of the centre right. Consequently, the true variance for the Partito Democratico also shows a bigger voters sentiment change because of the higher observed variance. This is consistent with 100% of polls classified as inaccurate using all accuracy measures employed (A , A' , and B_w). The story does not change very much when we consider only the last two months of the election campaign. As table 6.10 shows, the difference between the observed variance (7.22) and the error variance (1.93) is still comprising a bigger voters sentiment change than the centre right coalition. Therefore, we may argue that the outstanding percentage of inaccuracy among the poll readings for the Partito Democratico is mainly due to voters sentiment change, although the analysis so far has showed the presence of error caused by the house effect.

Regarding the main anti-system movement (Movimento 5 Stelle), table 6.9 reports that observed variance and the error variance over the six months of the election campaign are 5.62 and 1.11 respectively. Therefore, the true variance and the reliability are 4.62 and 0.80 respectively. In other words, over the six months of the election campaign the variance of poll readings for the Movimento 5 Stelle is caused more by movement in voters sentiment than the error caused by the sampling procedures. This is in line with the evidence provided by the house effect analysis presented in the previous section. Focusing on the last two months of the election campaign, the true variance still shows a shift in voters sentiment even if with less magnitude (3.10), confirmed also by a lower poll reliability (see table 6.10).

Regarding the centre coalition supporting the incumbent Prime Minister, table 6.9 reports the higher observed variance (11.69) in the series over the six months of the election campaign. In addition, both the error variance and sampling error are 1.11 and 1.05 respectively. Consequently, the voters sentiment change expressed by the true variance is the highest of the series (10.58). Therefore, we may argue that over the six months of the election campaign the inaccuracy of the poll readings for the main centre coalition is mainly due to a shift in voters sentiment. This is also consistent with the accuracy analysis reported in table 6.1, where the percentage of polls classified as inaccurate reaches 83%. However, when computing these measures for just the last two months of the election campaign both the observed variance and the true variance are halved. In other words, the shift in voters sentiment has less magnitude in the last part of the election campaign.

Concerning the Fare per Fermare il Declino party, table 6.9 reports that observed variance and error variance are 1.31 and 0.13. Given that the mean of poll readings over the six months of the election campaign is 1.57, the observed variance is considered high. Therefore, the true variance and the reliability show a shift in voters sentiment change. However, table 6.10 shows that the observed variance decreases over the last months of the election campaign. Consequently, the evidence shows less movement in voters sentiment expressed in lower values of true variance and reliability. We may argue that the inaccuracy of poll readings concerning the Fare per Fermare il Declino is mainly due to a shift in voters sentiment rather than error caused by the sampling procedures and that this change occurred with stronger

magnitude over the whole six months rather than in the last part of the election campaign.

As already pointed out in this chapter, the Rivoluzione Civile movement came into the race only in the last two months of the election campaign and therefore, we do not compute these measures for the whole election campaign. As table 6.10 reports, the observed variance and the error variance are 0.58 and 0.35 respectively. The true variance and the reliability show a small shift in voters sentiment. Therefore, we may argue that the inaccuracy of the small group of polls classified as inaccurate is caused both by the house effect and by voters sentiment change.

With regard to the small group of parties not aligned with any coalitions (Others), table 6.9 reports a very high observed variance (14.69) and low variance error (0.41). Therefore, very little error comes from the sampling procedure. Indeed, the values of true variance and reliability confirm a large shift in voters sentiment over the six months of the election campaign. The story does not change so much when focusing on the last two months of the election campaign. Although the observed variance and true variance values are halved, these measures still show a big shift in voters sentiment (see table 6.10). This is also consistent with the results of accuracy analysis. Therefore, we may argue that the inaccuracy of polls is mainly due to a shift in voters sentiment rather than the sampling procedures.

6.4.2 AR(1) Results

The previous analysis of the variance of poll readings for each coalition provided evidence of voters sentiment change in all the coalitions especially for the Partito Democratico and Others coalitions. In addition, these movements occurred both over the last six and during the last two months of the election campaign. This is also consistent with the outcomes given by the accuracy measures where there was a higher proportions of polls classified as inaccurate in 2013 than in the previous two general elections, except for the Rivoluzione Civile, which was the last to join the race (see table 6.1).

In order to estimate properly the degree of this movement, we will apply the autoregressive model (AR(1)) following the approach proposed by Erikson and Wlezien (1999, 2012). The model assumes that the true voters sentiment on a given day to be explained as a function of voters sentiment on the previous days and shocks from the election campaign (see formula 3.34). Specifically, the variance of daily shocks and their persistence will comprise the real movement when it occurs. Assuming that the poll series is stationary, the autoregressive parameter value will be between 0 and 1 and it will geometrically decay as the number of days between poll readings increases.

As for the previous analysis, we will discuss the outcomes of the AR(1) model for each coalition separately. According to the evidence provided by the previous analysis, we will apply the AR(1) model only to Partito delle Libertà, Partito

Table 6.11: 2013 Italian General Election: true voters sentiment change using AR(1) for Popolo della Libertà.

In the column called ‘Correlation’, the values refer to the coefficient using the AR(1) - formula 3.34 - with different lag of days. In the column called ‘True Correlation’, Heise’s procedure (1969) is applied by multiplying the observed correlation to reliability (last row of table 4.5). The statistical level of significance follows the rules: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

| | Correlation (γ) | True Correlation ($\gamma * rel$) | R^2 | RMSE |
|-------|--------------------------|-------------------------------------|-------|------|
| Lag 1 | 0.082 | 0.066 | 0.02 | 2.92 |
| Lag 2 | 0.109 | 0.087 | 0.03 | 2.87 |
| Lag 3 | 0.088 | 0.070 | 0.02 | 2.91 |
| Lag 4 | 0.073 | 0.058 | 0.02 | 2.95 |
| Lag 5 | 0.086 | 0.069 | 0.01 | 3.01 |
| Lag 6 | 0.091 | 0.073 | 0.01 | 3.01 |
| Lag 7 | 0.084 | 0.067 | 0.01 | 3.03 |

Democratico, the Movimento 5 Stelle, and Centre coalitions, which show the biggest movement in voters sentiment. Therefore, table 6.11 presents the outcomes of applying the AR(1) to the poll readings for the Partito della Libertà coalition. In the first column are reported the observed correlation between polls and their lagged values over 1 to 7 days. The main expectation is to observe a geometrical decay of values of the parameter (γ), which shows the movement of voters sentiment as the number of days between polls increases. However, table 6.11 reports that none of those correlations meets the level of statistical significance and the values of the parameter do not geometrically decay over time. However, the values meet the condition that the parameter is between 0 and 1. These outcomes do not provide evidence of a stationary process. Now, we take into account the statistical reliability

of poll readings in order to estimate the degree of voters sentiment change - the true over time correlation - excluding the amount of error that may result from random sampling. To do that, we apply the Heise procedure where we multiply the values of the parameter by the statistical reliability for the six months of the election campaign (0.80). The second column of table 6.11 reports the outcomes of the true over time correlation but the pattern of values does not change very much.

Table 6.12: 2013 Italian General Election: true voters sentiment change using AR(1) for Partito Democratico.

In the column called ‘Correlation’, the values refer to the coefficient using the AR(1) - formula 3.34 - with different lag of days. In the column called ‘True Correlation’, Heise’s procedure (1969) is applied by multiplying the observed correlation to reliability (last row of table 4.5). The statistical level of significance follows the rules: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

| | Correlation (γ) | True Correlation ($\gamma * rel$) | R^2 | RMSE |
|-------|--------------------------|-------------------------------------|-------|------|
| Lag 1 | 0.260*** | 0.211 | 0.12 | 3.08 |
| Lag 2 | 0.205** | 0.166 | 0.18 | 2.97 |
| Lag 3 | 0.182** | 0.147 | 0.14 | 3.03 |
| Lag 4 | 0.134 | 0.109 | 0.09 | 3.11 |
| Lag 5 | 0.182** | 0.147 | 0.08 | 3.09 |
| Lag 6 | 0.159* | 0.129 | 0.08 | 3.04 |
| Lag 7 | 0.158* | 0.128 | 0.04 | 3.11 |

Regarding the Partito Democratico coalition, table 6.12 reports the results obtaining when applying the AR(1) model. According to the previous analysis, the main expectation is to see a large shift in voters sentiment both in the long run and in the final stages of the election campaign. Therefore, we expect both the AR(1) conditions to be satisfied. According to table 6.12, the values of the parameter

mostly decay as the number of days between polls increases and most of them meet the statistical level of significance with different degrees. This series of poll readings does not fully satisfy the condition of geometrical decay, because of the values of lag of 5 days which rise up 0.182. In addition, the outcomes provide evidence that the shift in voters sentiment is bigger over the short than the long run. This is also confirmed by the Heise procedure which shows the true over-time correlation, taking into account the statistical reliability and excluding the error caused by random sampling.

Table 6.13: 2013 Italian General Election: true voters sentiment change using AR(1) for Movimento 5 Stelle.

In the column called ‘Correlation’, the values refer to the coefficient using the AR(1) - formula 3.34 - with different lag of days. In the column called ‘True Correlation’, Heise’s procedure (1969) is applied by multiplying the observed correlation to reliability (last row of table 4.5). The statistical level of significance follows the rules: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

| | Correlation (γ) | True Correlation ($\gamma * rel$) | R^2 | RMSE |
|-------|--------------------------|-------------------------------------|-------|------|
| Lag 1 | 0.199** | 0.159 | 0.30 | 2.02 |
| Lag 2 | 0.243*** | 0.194 | 0.21 | 2.16 |
| Lag 3 | 0.259*** | 0.207 | 0.21 | 2.18 |
| Lag 4 | 0.328*** | 0.262 | 0.20 | 2.21 |
| Lag 5 | 0.390*** | 0.312 | 0.18 | 2.29 |
| Lag 6 | 0.433*** | 0.346 | 0.19 | 2.26 |
| Lag 7 | 0.415*** | 0.332 | 0.19 | 2.27 |

Regarding the main anti-system movement (Movimento 5 Stelle), the expectation is to observe a large shift in voters sentiment over the election campaign but with less magnitude in the last part. Therefore, both the AR(1) conditions must be

satisfied. However, table 6.13 reports that the values of the parameter increase as the number of days between polls increases. In addition, they all meet the highest level of statistical significance, except the value of the parameter using the lag of 1 day between polls. According to this, the condition of geometrical decays is not clearly satisfied and the model seems to follow an explosive rather than a stationary process. This is also confirmed when using the Heise procedure in order to take into account the statistical reliability and excluding the error caused by random sampling. In the light of this evidence, we may argue that there was a significant movement in the voters sentiment concerning the Movimento 5 Stelle that affected the accuracy of polls reading over the election campaign. This is also confirmed by the previous analysis on the accuracy measures and the house effect.

Table 6.14: 2013 Italian General Election: true voters sentiment change using AR(1) for Centre.

In the column called ‘Correlation’, the values refer to the coefficient using the AR(1) - formula 3.34 - with different lag of days. In the column called ‘True Correlation’, Heise’s procedure (1969) is applied by multiplying the observed correlation to reliability (last row of table 4.5). The statistical level of significance follows the rules: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

| | Correlation (γ) | True Correlation ($\gamma * rel$) | R^2 | RMSE |
|-------|--------------------------|-------------------------------------|-------|------|
| Lag 1 | 0.337*** | 0.303 | 0.35 | 2.77 |
| Lag 2 | 0.421*** | 0.379 | 0.33 | 2.84 |
| Lag 3 | 0.487*** | 0.438 | 0.32 | 2.88 |
| Lag 4 | 0.465*** | 0.419 | 0.33 | 2.89 |
| Lag 5 | 0.459*** | 0.413 | 0.32 | 2.93 |
| Lag 6 | 0.443*** | 0.399 | 0.33 | 2.92 |
| Lag 7 | 0.501*** | 0.451 | 0.30 | 2.99 |

Regarding the Centre coalition supporting the incumbent Prime Minister, table 6.14 reports similar patterns as those shown earlier for the Movimento 5 Stelle. In other words, all the values of the parameter meet the level of statistical significance and do not geometrically decay as the number of days between poll readings increases. As with the previous series, the values of parameter also present the same pattern when using the Heise procedure. According to this, we may argue that the inaccuracy of poll readings is caused by the strong presence of voters sentiment change over the six months of the election campaign.

6.5 Conclusion

Was the 2013 Italian polling less successful in predicting the election outcomes than in the previous two elections? According to what has emerged from the analysis presented in this chapter, the answer to this question is: yes, it was. Indeed, all the accuracy measures employed (A , A' , and B_w) showed a high percentage of polls classified as inaccurate for almost all the parties/coalitions competing in the election campaign (see tables 6.1 and 6.2).

In the light of this, we applied the OLS regressions and the lowess procedure to poll readings and accuracy values to see the degree of the house effect and random error in them. The evidence provided by tables 6.4 and 6.5 confirmed the strong impact of the house effect in Italian polling. Therefore, this hypothesis has been strongly confirmed in all the poll readings series using both OLS regression model

and the lowess procedure. Using the multivariate regression model to estimate the impact of methodologies employed by the polling house on the predictive accuracy of poll readings, we can draw at least three main conclusions. Firstly, the CAWI delivery system has a greater positive impact than in the previous elections especially for the bigger parties/coalitions. Secondly, who commissioned the poll plays different roles depending on the measure employed. Indeed, in the models where B_w is the dependent variable the three variables have a negative relationship and, therefore, increase the estimated error (see table 6.6). Conversely, in the models where A' measures are the dependent variables, the signs of their coefficients become positive. Thirdly, the evidence reported a negative impact on the accuracy of polls by the media actors especially concerning the small parties.

To estimate the degree of voters movement over the election campaign, we employed two different analyses: the variance and the autoregressive models. Despite the low presence of error variance, the autoregressive model does not provide evidence of large voters movements over the campaign. Instead, Italian voters sentiment follows more of a random walk with *drift* than a stationary process as expected. Specifically, voters sentiment change occurred in the first part of the election campaign with regard to the Movimento 5 Stelle and the Centre coalition (see tables 6.13 and 6.14). There is also evidence of stronger presence of long-term effects on the election campaign.

With this in mind, the performance of polls in terms of accuracy in the 2013 general election is more affected by the house effect than any movement over the

election campaign, especially with regard to the two main coalitions of centre-right and centre-left. Therefore, all the methodologies employed by the pollsters in carrying out the polls to predict voting intention is the main reason for inaccuracy of their performance.

Chapter 7

Conclusion

We always want the best man to win the election. Unfortunately, he never runs.

W. Rogers

Over the last two decades, the use of polls during an election campaign has become increasingly commonplace and have at least two purposes. Firstly, polls are used as a tool to *forecast* actual election results (Hillygus 2011). Secondly, the information provided by polls concerning the level of support among voters is employed to determine and/or emphasize issues on the political agenda and manifestos by campaign strategists (Hillygus 2011; Eisinger 2003). Moreover, some scholars have pointed out how polls are able to *bring home* important information (*fundamentals*) to voters (Gelman and King 1993; Erikson and Wlezein 2012). The main purpose of this thesis is to shed light on the causes of inaccuracy in Italian polling over the last three general elections (2006, 2008, and 2013). Accordingly, explaining what has most caused inaccuracy of polls over an election competition, allows us to explain

to what extent the *fundamentals* actually do matter and how voters sentiment has been influenced by the campaign itself. Therefore, two main hypotheses have been derived:

- **H1:** The inaccuracy of polls is caused by the house effect;
- **H2:** The inaccuracy of polls is caused by voters changing their decisions between the time the polls are carried out and Election Day;

The previous chapters have discussed the role of polls and all the issues concerning their use in the literature so far. In addition, chapter 3 was devoted to explaining the methods applied to test the two hypotheses. Specifically, we employed the well-established A accuracy measure and its revision to fit the Italian case (A') in order to estimate the proportion of polls classified as inaccurate in Italian polling. Moreover, A' measure also provides evidence on the under- or overestimation for a given political party/coalition. To estimate the overall statistical error among poll readings, we employ the B_w measure that also allows us to correct the dependency for the given political party using the A' measure. Then, we applied a well-established econometric procedure in order to estimate the house effect using the OLS regression model and the *lowess* procedure. Moreover, we employed a multivariate regression model to estimate the impact of each methodology used by polling houses on the predictive accuracy of poll readings. To do that, we regressed the accuracy indexes on a set of dummy variables for each methodology employed as documented by pollsters and an exogenous variable (see formula 3.15). This allows us also to estimate

the methodological robustness of Italian polling. To test voters sentiment change, we employed the autoregressive model (AR(1)) assuming that the level of support for a given political party/coalition in a day is a function of voters sentiment change from the previous day and shocks from the election campaign (see formula 3.34). The last three chapters have been devoted to presenting the empirical results of those methods.

7.1 The predictive accuracy

According to the three previous chapters, the outcomes of the accuracy measures show that all the general elections taken into account have been characterized by a high percentage of polls classified as inaccurate. Moreover, the main centre-right coalitions (Casa/Popolo delle Libertà) have been constantly underestimated over time and especially in the final part of election campaigns (see tables 4.2, 5.2, and 6.2). Conversely, the main centre-left coalitions (Unione/Partito Democratico) have been overestimated in all three general elections (see tables 4.2, 5.2, and 6.2). Surprisingly, adding together the poll readings of parties/coalitions on the basis of their centre-right or centre-left orientation, the outcomes of accuracy measures (A and A') provide evidence of a weaker performance in terms of accuracy of polls both for the centre-right and centre-left coalitions (see table 5.3). Therefore, we can argue that there is evidence of source of error in Italian polling. Indeed, the degree of error estimated by the B_w measure increases across the three general elections. This is

also confirmed by the percentages of statistically biased polls using the χ^2 test with the threshold of $p \leq 0.05$. This percentage increases from 76% in 2006 to 100% in 2013 (see tables 4.1, 5.1, and 6.1). Accordingly, we can conclude that there is a persistent degree of inaccuracy in Italian polling over time.

7.2 The degree of house effect

Regarding the house effect, this hypothesis has been confirmed using both the OLS regression model and the *lowess* procedure in all three elections, especially in the model where the poll readings are dependent variables. Therefore, the variance of polls is fully explained by the variance of days and the polling houses carrying them out during election campaigns (see tables 4.3, 5.4, 5.5, 6.4, and 6.5).

According to the multivariate regression model outcomes, we can draw at least three conclusions. Firstly, the use of random sampling procedures does not always increase the predictive accuracy of poll readings. This is also evidence of lack of methodological robustness in Italian polling. Secondly, the delivery system has a different impact on the accuracy of poll readings on the basis of parties/coalitions. For instance, the use of the CATI system decreases the predictive accuracy of polls for the bigger parties/coalitions, whereas it increases it for the small coalition of Others (see tables 5.7 and 5.8). Thirdly, in the last two election campaigns the media and the buyers played an important role in the predictive accuracy of poll readings. For instance, in 2013 all the dummy variables employed as buyer have a

statistically positive relationship with the bigger parties/coalitions in the election campaign (see table 6.7).

7.3 The extent of voters sentiment change

The hypothesis of voters sentiment change has not been fully confirmed by the autoregressive model in any of the elections. Instead, the outcomes provided evidence that Italian voters sentiment follows a *random walk with drift* rather than a stationary process as assumed by the model employed. In addition, those series that are statistically significant show that any change among Italian voters occurred at the beginning of election campaigns. Accordingly, the *fundamentals* of Italian campaigns do matter only at the start of campaigns where there is reliable evidence of change among voters.

To sum up, there is strong evidence that inaccuracy in Italian polling is caused more by the house effect than by any movement in voters sentiment over the last three general election campaigns.

7.4 The overall type of polls performance

At the end of the chapter concerning the literature on the use of polls during election campaigns, we classified the performance of polls in predicting electoral results into four different types of accuracy/inaccuracy (see figure 2.1). We also specified that this thesis aims to investigate only two types of accuracy/inaccuracy: when

the poll performance is classified as bad and failed predictors. Recalling their features, the former occurs when a poll is statistically inaccurate but methodologically robust. The second type is represented by a poll that is statistically inaccurate and methodologically not robust. In the light of the outcomes provided by the accuracy measures and the house effect (in particular by the multivariate regression model), we conclude that Italian polling can be defined as failed predictors. Specifically, the high percentages of polls classified as inaccurate using the A and A' measures and the percentages of statistically biased polls using the χ^2 test with the threshold of $p \leq 0.05$ using the B_w are strong evidence of statistical inaccuracy.

On the other hand, almost all the multivariate regression models failed to provide evidence of methodological robustness across the poll readings over the course of the last three Italian general elections. Therefore, the answer to the broad question of this thesis is that the strong presence of statistical inaccuracy and lack of methodological robustness are the conditions under which polls are not accurate as predictors of voters' behaviour.

Chapter 8

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Appendix A

Appendix

Revised A measure for the 2006 Italian General Election

To obtain a measure of the accuracy of poll predictions for the *Unione*, we rewrite equation 3.1 as follows:

$$A'_u = \ln \left[\frac{(u/(cdl + o))}{(U/(CDL + O))} \right] \quad (\text{A.1})$$

and to obtain a measure of the accuracy of poll predictions for *Others* parties:

$$A'_o = \ln \left[\frac{(o/(cdl + u))}{(O/(CDL + U))} \right] \quad (\text{A.2})$$

To obtain the variance of A' for the *Unione*, we rewrite equation 3.2 as follows:

$$\text{Variance}(A'_u) = 1/(n \cdot u \cdot (cdl + o)) \quad (\text{A.3})$$

To obtain the variance of A' for the *Others*, we rewrite equation 3.2 as follows:

$$\text{Variance}(A'_o) = 1/(n \cdot o \cdot (cdl + u)) \quad (\text{A.4})$$

Revised A measure for the 2008 Italian General Election

To obtain a measure of the accuracy of poll predictions for the *Partito Democratico*, we rewrite equation 3.1 as follows:

$$A'_{pd} = \ln \left[\frac{(pd/(pdl + sa + udc + o))}{(PD/(PDL + SA + UDC + O))} \right] \quad (\text{A.5})$$

and to obtain a measure of the accuracy of poll predictions for the *Sinistra Arcobaleno*

$$A'_{sa} = \ln \left[\frac{(sa/(pdl + pd + udc + o))}{(SA/(PDL + PD + UDC + O))} \right] \quad (\text{A.6})$$

and to obtain a measure of accuracy of poll predictions for the Unione dei Democratici Cristiani e di Centro (UDC)

$$A'_{udc} = \ln \left[\frac{(udc/(pdl + pd + sa + o))}{(UDC/(PDL + PD + SA + O))} \right] \quad (\text{A.7})$$

and to obtain a measure of accuracy of poll predictions for Others:

$$A'_o = \ln \left[\frac{(o/(pdl + pd + sa + udc))}{(O/(PDL + PD + SA + UDC))} \right] \quad (\text{A.8})$$

To obtain the variance of value of A' for the Partito Democratico, we rewrite equation 3.2 as follows:

$$\text{Variance}(A'_{pd}) = 1/(n \cdot pd \cdot (pdl + sa + udc + o)) \quad (\text{A.9})$$

To obtain the variance of value of A' for the Sinistra Arcobaleno, we rewrite equation 3.2 as follows:

$$\text{Variance}(A'_{sa}) = 1/(n \cdot sa \cdot (pdl + pd + udc + o)) \quad (\text{A.10})$$

To obtain the variance of value of A' for the Unione dei Democratici Cristiani e di Centro (UDC) we rewrite equation 3.2 as follows:

$$\text{Variance}(A'_{udc}) = 1/(n \cdot udc \cdot (pdl + pd + sa + o)) \quad (\text{A.11})$$

To obtain the variance of value of A' for Others, we rewrite equation 3.2 as follows:

$$\text{Variance}(A'_o) = 1/(n \cdot o \cdot (pdl + pd + sa + udc)) \quad (\text{A.12})$$

To obtain a measure of accuracy of poll predictions for the Partito Democratico, we rewrite equation 3.1 as follows:

$$A'_{coal;pd} = \ln \left[\frac{(pd/(pdl + o))}{(PD/(PDL + O))} \right] \quad (\text{A.13})$$

and to obtain a measure of accuracy of poll predictions for Others:

$$A'_{coal;o} = \ln \left[\frac{(o/(pdl + pd))}{(O/(PDL + PD))} \right] \quad (A.14)$$

To obtain the variance of values of A' for the Partito Democratico, we rewrite equation 3.2 as follows:

$$Variance(A'_{coal;pd}) = 1/(n \cdot pd \cdot (pdl + o)) \quad (A.15)$$

To obtain the variance of values of A' for the Others , we rewrite equation 3.2 as follows:

$$Variance(A'_{coal;o}) = 1/(n \cdot o \cdot (pdl + pd)) \quad (A.16)$$

Revised A measure for the 2013 Italian General Election

To obtain a measure of the accuracy of poll predictions for the Partito Democratico, we rewrite equation 3.1 as follows:

$$A'_{pd} = \ln \left[\frac{(pd/(pdl + m5s + cdm + rc + ffd + o))}{(PD/(PDL + M5S + CDM + RC + FFD + O))} \right] \quad (A.17)$$

and to obtain a measure of the accuracy of poll predictions for the Movimento 5 Stelle:

$$A'_{m5s} = \ln \left[\frac{(m5s/(pdl + pd + cdm + rc + ffd + o))}{(M5S/(PDL + PD + CDM + RC + FFD + O))} \right] \quad (A.18)$$

and to obtain a measure of the accuracy of poll predictions for the Coalizione di Centro:

$$A'_{cdm} = \ln \left[\frac{(cdm/(pdl + pd + m5s + rc + ffd + o))}{(CDM/(PDL + PD + M5S + RC + FFD + O))} \right] \quad (A.19)$$

and to obtain a measure of the accuracy of poll predictions for Rivoluzione Civile:

$$A'_{rc} = \ln \left[\frac{(rc/(pdl + pd + m5s + cdm + ffd + o))}{(RC/(PDL + PD + M5S + CDM + FFD + O))} \right] \quad (A.20)$$

and to obtain a measure of the accuracy of poll predictions for Fare per Fermare

il Declino:

$$A'_{ffd} = \ln \left[\frac{(ffd/(pdl + pd + m5s + cdm + rc + o))}{(FFD/(PDL + PD + M5S + CDM + RC + O))} \right] \quad (\text{A.21})$$

and to obtain a measure of the accuracy of poll predictions for Others:

$$A'_o = \ln \left[\frac{(o/(pdl + pd + m5s + cdm + rc + ffd))}{(O/(PDL + PD + M5S + CDM + RC + FFD))} \right] \quad (\text{A.22})$$

To obtain variance of the values of A' for Partito Democratico, we rewrite equation 3.2 as follows:

$$\text{Variance}(A'_{pd}) = 1/(n \cdot pd \cdot (pdl + m5s + cdm + rc + ffd + o)) \quad (\text{A.23})$$

To obtain variance of the values of A' for the Movimento 5 Stelle, we rewrite equation 3.2 as follows:

$$\text{Variance}(A'_{m5s}) = 1/(n \cdot m5s \cdot (pdl + pd + cdm + rc + ffd + o)) \quad (\text{A.24})$$

To obtain variance of the values of A' for the Centre, we rewrite equation 3.2 as follows:

$$\text{Variance}(A'_{cdm}) = 1/(n \cdot cdm \cdot (pdl + pd + m5s + rc + ffd + o)) \quad (\text{A.25})$$

To obtain variance of the values of A' for Rivoluzione Civile, we rewrite equation 3.2 as follows:

$$\text{Variance}(A'_{rc}) = 1/(n \cdot rc \cdot (pdl + pd + m5s + cdm + ffd + o)) \quad (\text{A.26})$$

To obtain variance of the values of A' for Fare per Fermare il Declino, we rewrite equation 3.2 as follows:

$$Variance(A'_{ffd}) = 1/(n \cdot ffd \cdot (pdl + pd + m5s + cdm + rc + o)) \quad (A.27)$$

To obtain variance of the values of A' for Others, we rewrite equation 3.2 as follows:

$$Variance(A'_o) = 1/(n \cdot o \cdot (pdl + pd + m5s + cdm + rc + ffd)) \quad (A.28)$$

To obtain a measure of the accuracy of poll predictions for the Partito Democratico, we rewrite equation 3.1 as follows:

$$A'_{coal;pd} = \ln \left[\frac{(pd/(pdl + m5s))}{(PD/(PDL + M5S))} \right] \quad (A.29)$$

and to obtain a measure of the accuracy of poll predictions for the Movimento 5 Stelle

$$A'_{coal;m5s} = \ln \left[\frac{(m5s/(pdl + pd))}{(M5S/(PDL + PD))} \right] \quad (A.30)$$

To obtain variance of the values of A' for Partito Democratico (only three party/coalition), we rewrite equation 3.2 as follows:

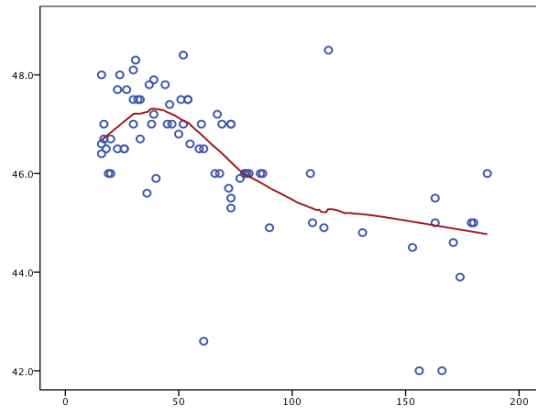
$$Variance(A'_{coal13;pd}) = 1/(n \cdot pd \cdot (pdl + m5s)) \quad (A.31)$$

To obtain variance of the values of A' for Movimento 5 Stelle (only three party/coalition), we rewrite equation 3.2 as follows:

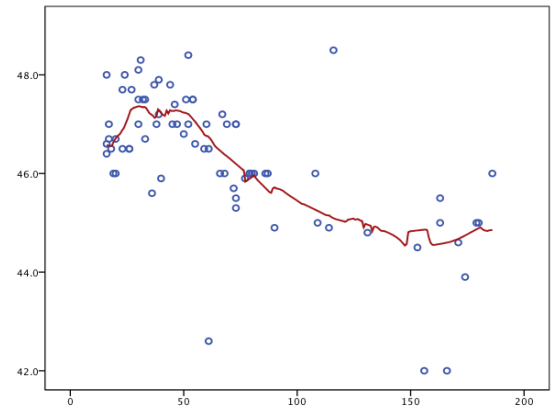
$$Variance(A'_{coal13;m5s}) = 1/(n \cdot m5s \cdot (pdl + pd)) \quad (A.32)$$

2006 Italian General Election: Smoothed Scatter Plots

Figure A.1: Smoothed scatter plots of house-adjusted polls aggregated by date: Casa Delle Libertá.

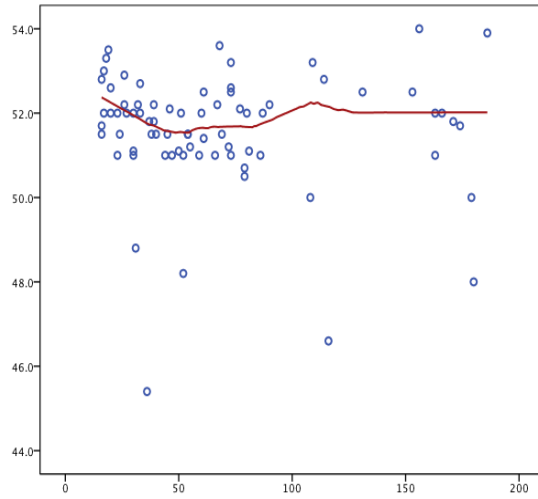


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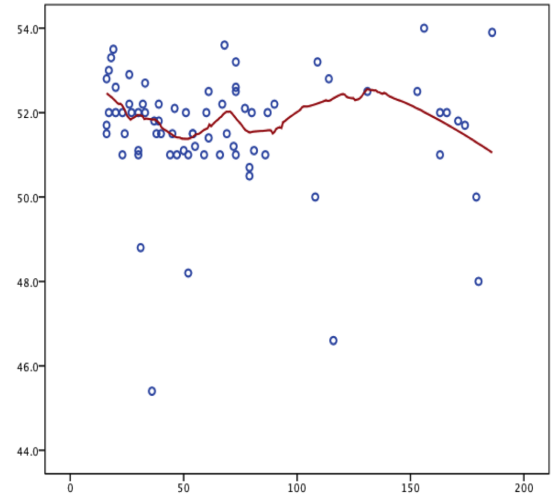


(b) Bandwidth = 0.20

Figure A.2: Smoothed scatter plots of house-adjusted polls aggregated by date: Unione.

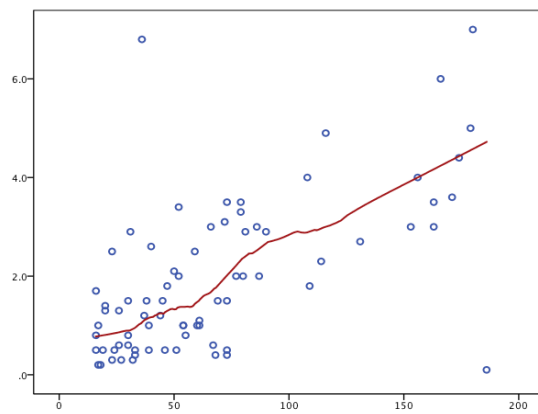


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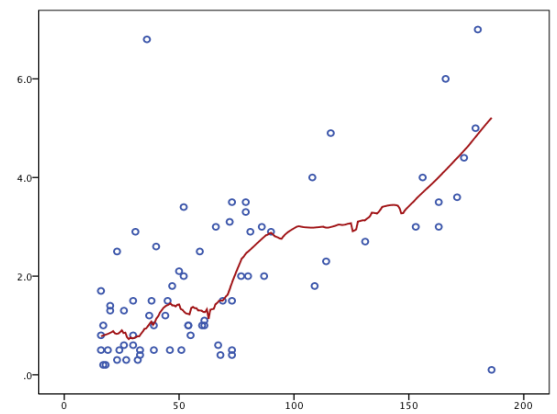


(b) Bandwidth = 0.20

Figure A.3: Smoothed scatter plots of house-adjusted polls aggregated by date: Others.



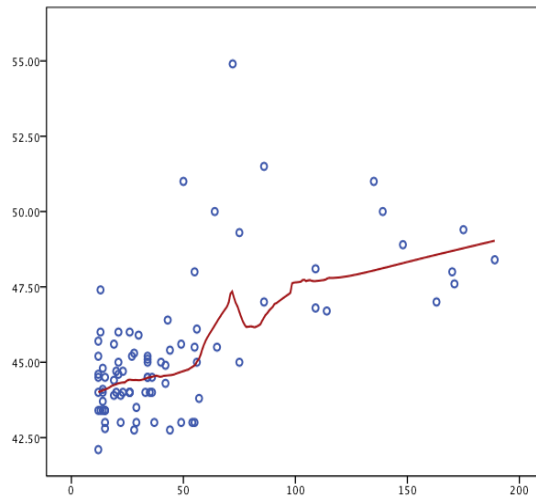
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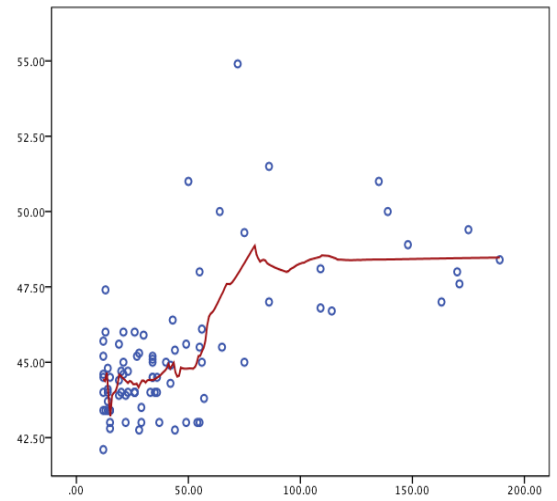
(b) Bandwidth = 0.20

2008 Italian General Election: Smoothed Scatter Plots

Figure A.4: Smoothed scatter plots of house-adjusted polls aggregated by date: Popolo della Libertà

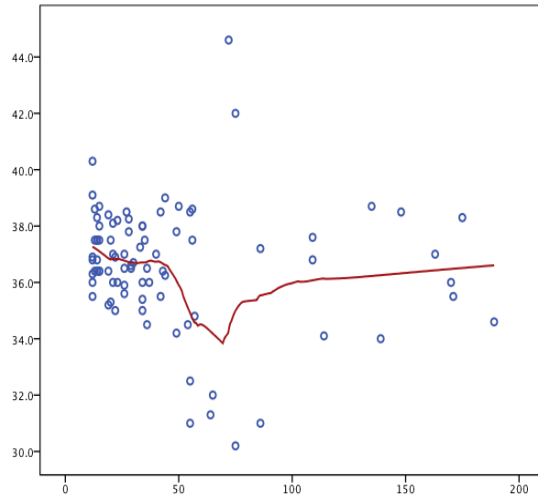


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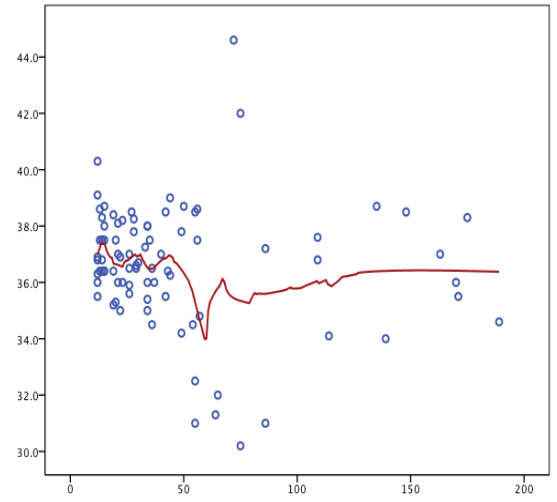


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Figure A.5: Smoothed scatter plots of house-adjusted polls aggregated by date: Partito Democratico

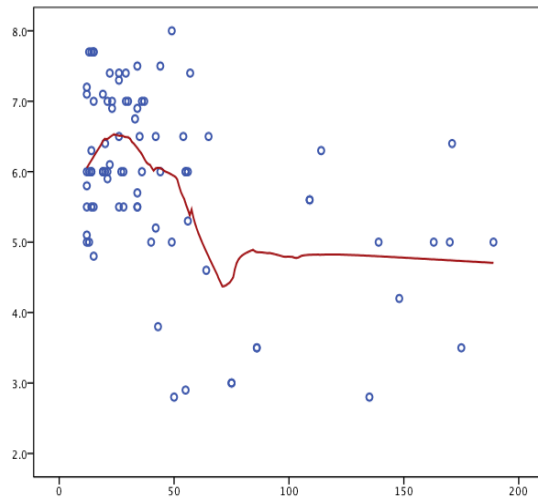


(a) Bandwidth = 0.40

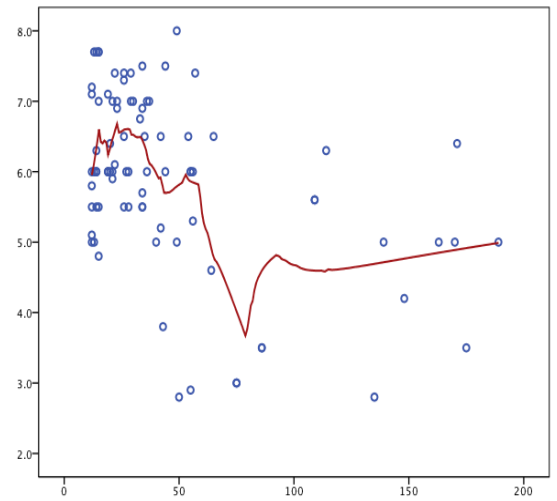


(b) Bandwidth = 0.20

Figure A.6: Smoothed scatter plots of house-adjusted polls aggregated by date: UDC

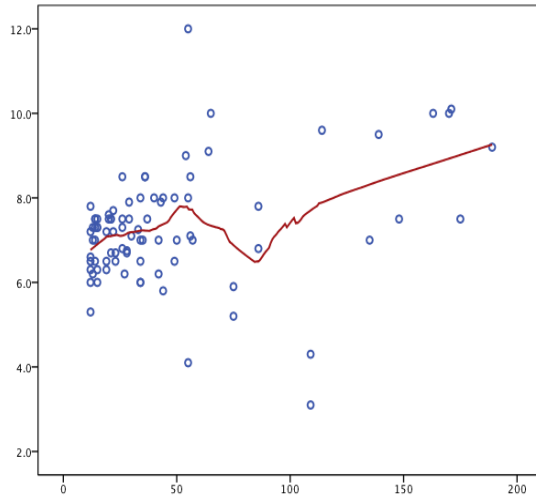


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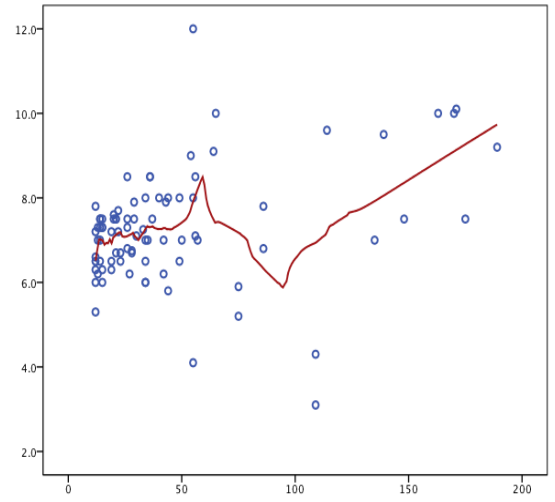


(b) Bandwidth = 0.20

Figure A.7: Smoothed scatter plots of house-adjusted polls aggregated by date: Sinistra Arcobaleno

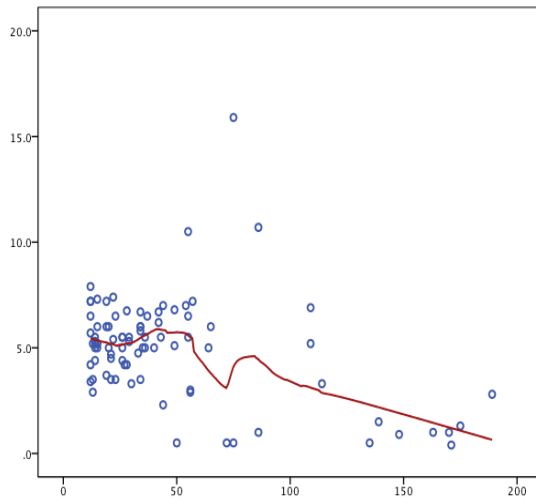


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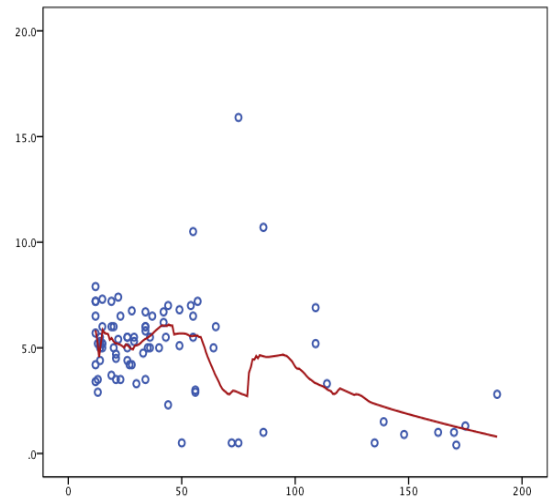


(b) Bandwidth = 0.20

Figure A.8: Smoothed scatter plots of house-adjusted polls aggregated by date: Others

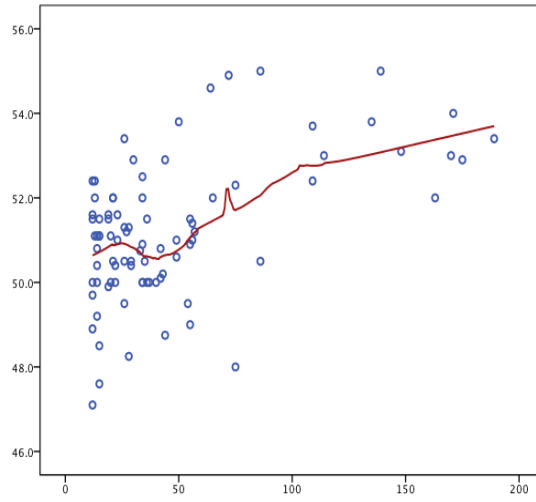


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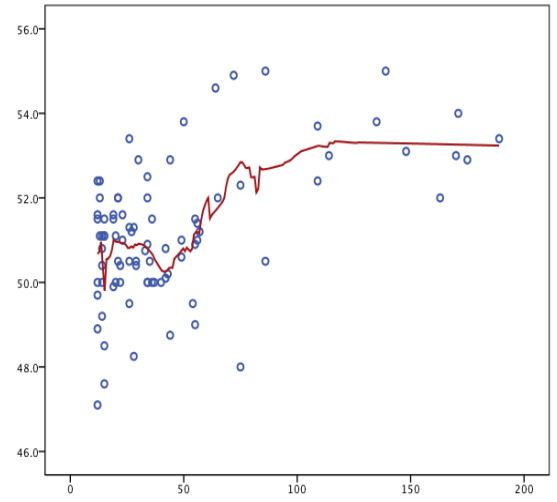


(b) Bandwidth = 0.20

Figure A.9: Smoothed scatter plots of house-adjusted polls aggregated by date: Centre Right Coalition

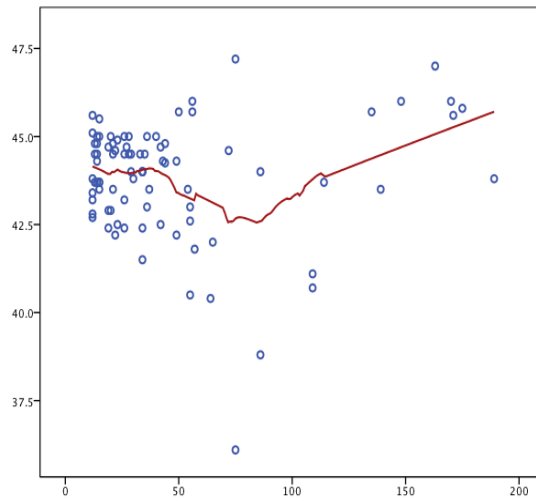


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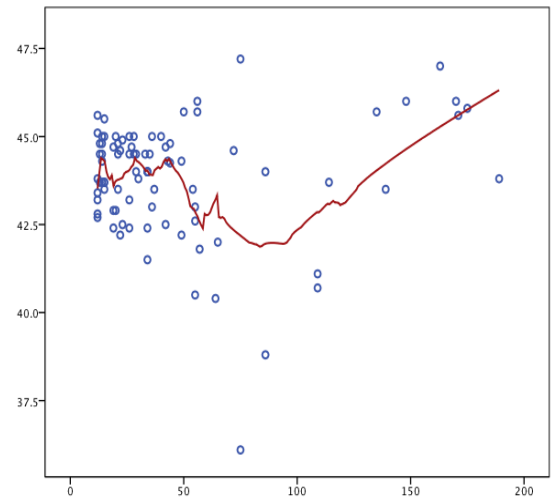


(b) Bandwidth = 0.20

Figure A.10: Smoothed scatter plots of house-adjusted polls aggregated by date: Centre Left Coalition



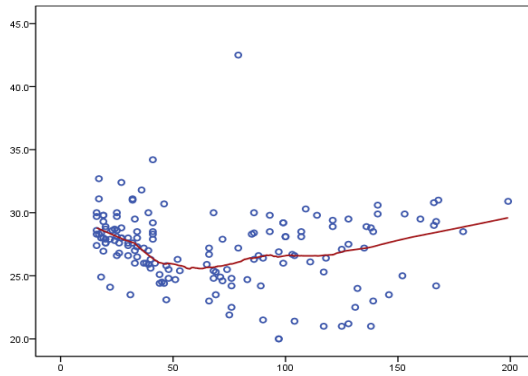
(a) Bandwidth = 0.40



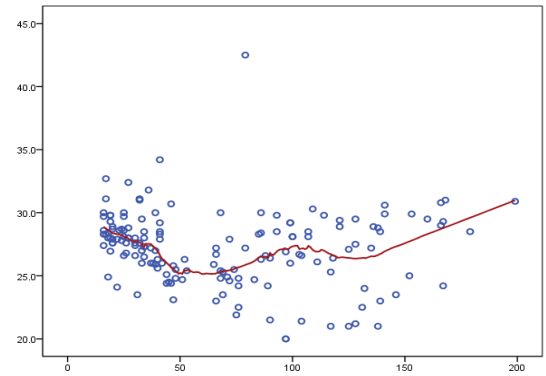
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2013 Italian General Election: Smoothed Scatter Plots

Figure A.11: Smoothed scatter plots of house-adjusted polls aggregated by date: Popolo Delle Libertà

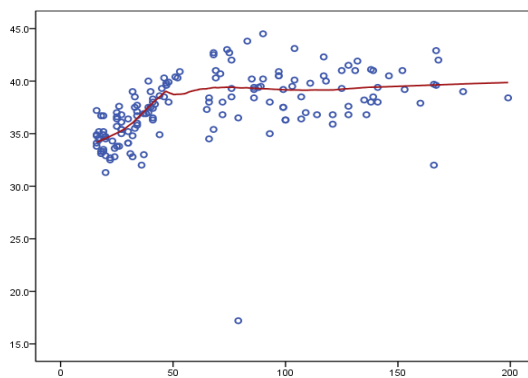


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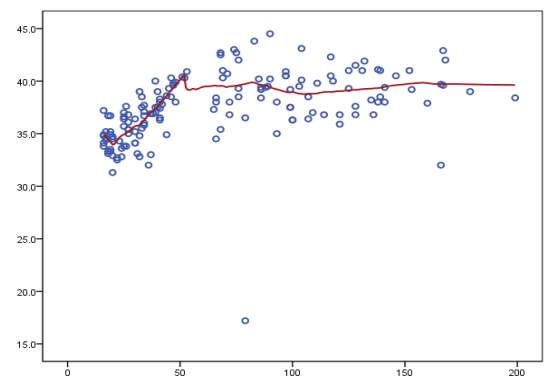


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Figure A.12: Smoothed scatter plots of house-adjusted polls aggregated by date: Partito Democratico

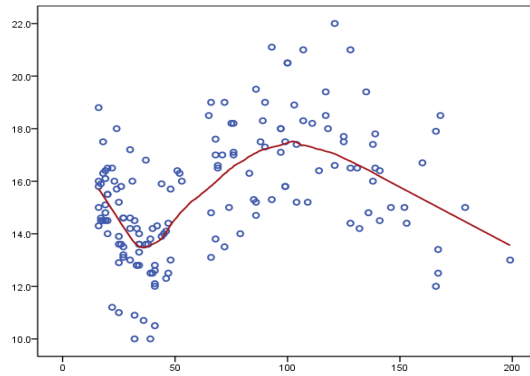


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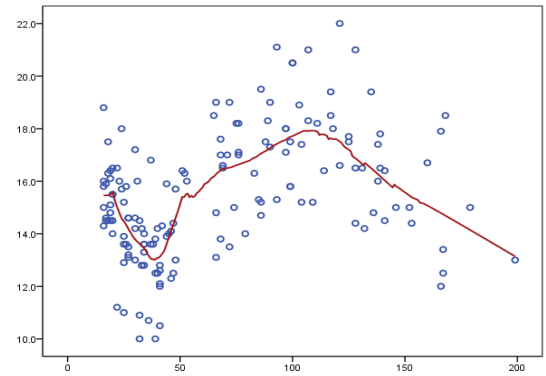


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Figure A.13: Smoothed scatter plots of house-adjusted polls aggregated by date: Movimento 5 Stelle

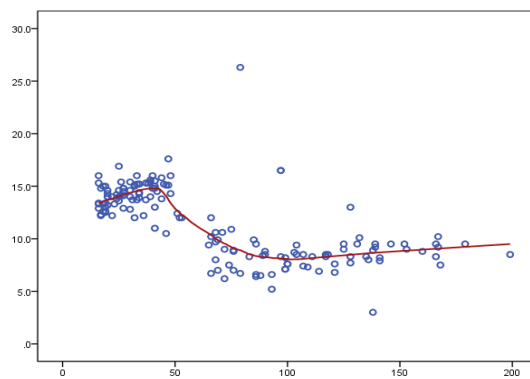


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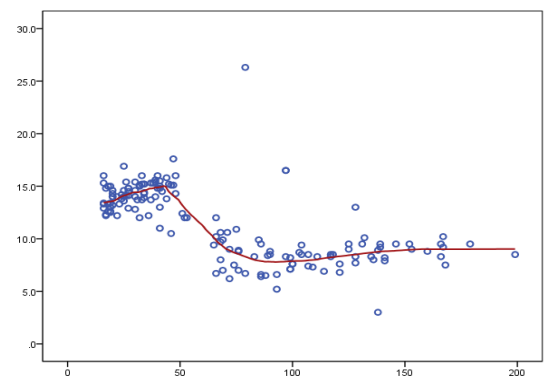


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Figure A.14: Smoothed scatter plots of house-adjusted polls aggregated by date: Centre

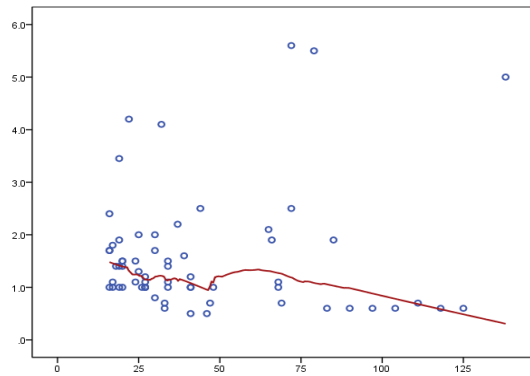


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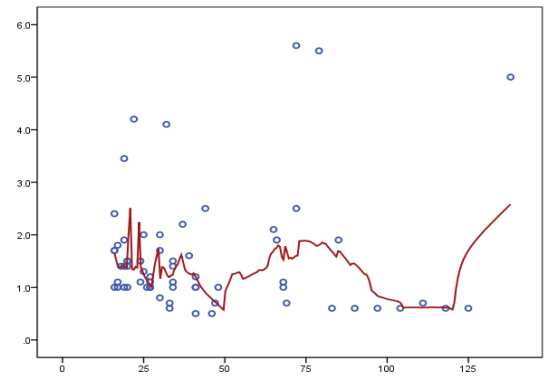


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Figure A.15: Smoothed scatter plots of house-adjusted polls aggregated by date: Fare per Fermare il Declino

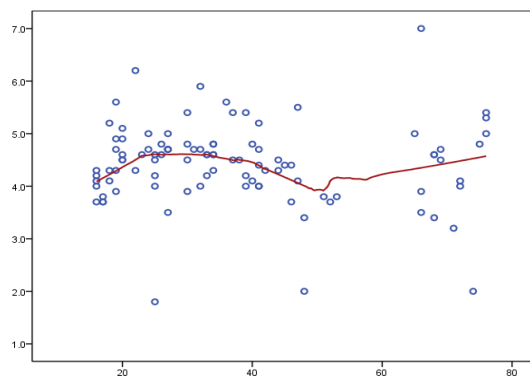


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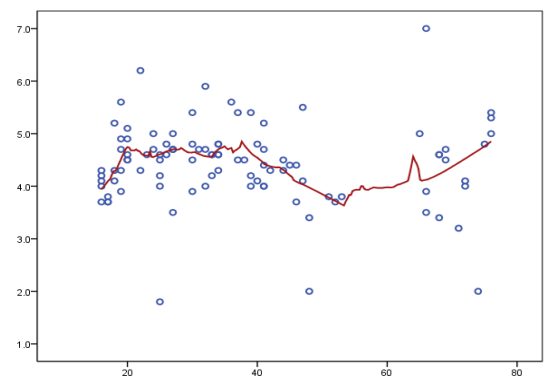


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Figure A.16: Smoothed scatter plots of house-adjusted polls aggregated by date: Rivoluzione Civile

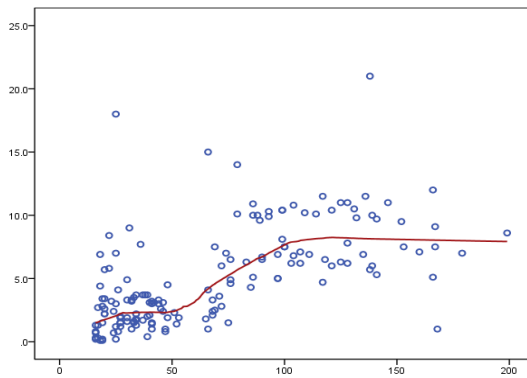


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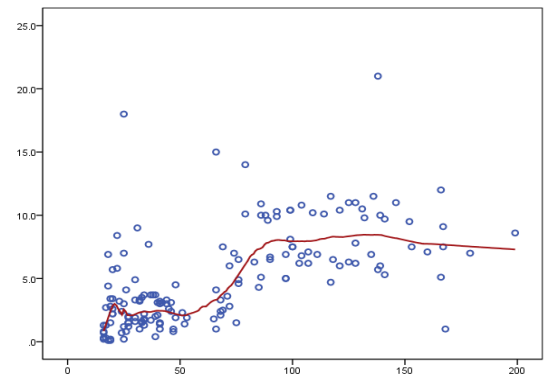


(b) Bandwidth = 0.20

Figure A.17: Smoothed scatter plots of house-adjusted polls aggregated by date: Others



(a) Bandwidth = 0.40



(b) Bandwidth = .20